

ROADS AND STREETS

FEBRUARY 1943



Gar Wood 20 cu. yd. Hydraulic Scraper propelled by two Allis-Chalmers Model HD 14 tractors at work on U. S. Route 127 in Iowa. Timken Bearings used in all equipment.

Give your
construction equip-
ment greater work ca-
pacity for Victory. Use
Timken Bearings through-
out. Be prepared for
post-war con-
ditions.

When Timken Tapered Roller Bearings are installed at every suitable position in any machine, that machine invariably is superior in every phase of performance — in speed, strength, accuracy and endurance.

It not only is a *better* machine however — but also a *better selling* machine; for the trade-mark "TIMKEN" is universally accepted as a sure guide to quality

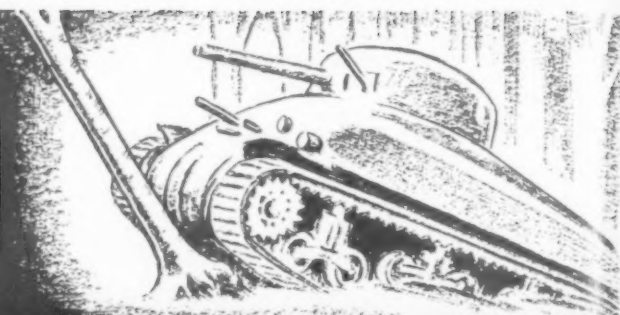
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

"There Is In Bearings"

The one test for every decision
Will it help to win the war?

STRENGTH



TO KEEP YOUR GRADERS ROLLING FOR VICTORY...

- ✓ Check condition of engine regularly.
- ✓ Change lubricating oil and renew filter elements every 100 hours of use.
- ✓ Lubricate all parts of grader regularly.
- ✓ Service air cleaner every 10 hours of use.
- ✓ Clean fuel oil filters at least every 60 hours.
- ✓ Don't ride clutch. Adjust clutch pedal when and as needed.
- ✓ Keep electrical system in good condition —check battery regularly.
- ✓ Keep lost motion out of grader—use adjustments for wear and replace parts worn out.
- ✓ Keep tires inflated to recommended pressure.

If you need help or advice on any of the above, see your local Adams distributor.

★ ★ **STRENGTH**, backed by power, enables our gigantic tanks to ride rough-shod over the toughest obstacles and clear the way for advancing troops . . . **STRENGTH**, backed by power, also enables Adams Motor Graders to clear and grade roadways quickly and efficiently through difficult natural obstacles on every continent to pave the way for vital war-time transport. **STRENGTH** is but one of the many features you'll like in Adams Motor Graders when once again you are permitted to buy equipment for use on peace-time projects!

J. D. ADAMS COMPANY • INDIANAPOLIS, INDIANA

Adams motor graders, leaning wheel graders, elevating graders, hauling scrapers, tamping rollers, bulldozers and road maintainers are used by allied forces throughout the world.

Adams
ROAD-BUILDING AND
EARTH-MOVING EQUIPMENT

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SAFE WAYS IN WAR PRODUCTION



NEW WORKER—Every new employee in a Bethlehem Plant wears this button. It helps to fix his attention on safety. It signals to more experienced employees that he is new to the plant, and they keep an eye on him, and do not hesitate to offer friendly guidance in case he forgets instructions and unknowingly breaks any safety regulation.

Industrial accidents, bad enough because of the human distress they cause, are also a grievous drag on production. Every day that injury lays up a worker means lowered output of the materials our armed forces are asking for.

Safety engineers know they must be more than ever on guard as pressure for production intensifies and men work against time. When war came, Bethlehem Steel Company expanded its accident-prevention program to meet the new conditions. Special efforts were addressed to the new employee to make him safety-conscious from the moment he walked into the plant. And by posters, group meetings and individual instruction, the safe way of doing his job was ground into the subconscious of new Bethlehem employee and veteran alike.

Significant are the results of a current study, showing that of all disabling accidents to Bethlehem employees less than one-third occur in the course of their work. Even with employment rolls upped by the tens of thousands and plant operations at top speed to meet the demands of the war program, the Bethlehem employee is safest, best protected against injury, during the hours he spends on the job.



AUTOMATIC HAND GUARD—This man is operating a trimming press. If he should absent-mindedly let his hands move too near the danger zone, the two cables will automatically whisk them back to safety, before the ram of the press descends.



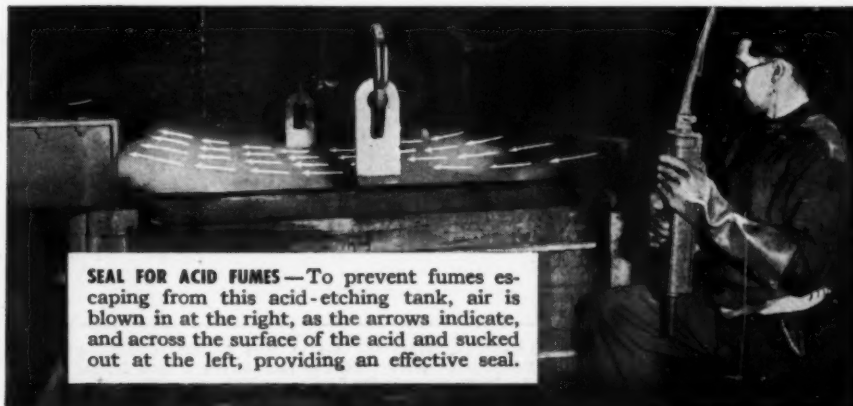
100% HEAT-INSULATED—Asbestos-covered hood, chrome-leather full-length apron, chrome-leather gloves, chrome-leather full-length sleeves and asbestos guard on torch handle give this worker complete protection against heat and flying sparks.



EYES DOUBLY GUARDED—Even though this grinder is equipped with a heavy glass shield, the eyes of the man who is operating it are given further protection against sparks or flying bits of abrasive by the cup goggles that he is wearing.



Bethlehem Steel Company is actively supporting the National Safety Council in its campaign against accidents in war production, through the War Production Fund to Conserve Manpower.



SEAL FOR ACID FUMES—To prevent fumes escaping from this acid-etching tank, air is blown in at the right, as the arrows indicate, and across the surface of the acid and sucked out at the left, providing an effective seal.

ROADS AND STREETS

Vol. 86, No. 2

February, 1943



A magazine devoted to the design, construction, maintenance and operation of highways, streets, bridges, bridge foundations and grade separations; and to the construction and maintenance of airports.

WITH ROADS AND STREETS HAVE BEEN COMBINED GOOD
ROADS MAGAZINE AND ENGINEERING & CONTRACTING

CONTENTS

126 Acre Soil-Cement Landing Mat for Navy Planes . . .	35
ALCAN HIGHWAY—Conclusion of series of articles	
By HAROLD J. McKEEVER Associate Editor, Roads and Streets	
8—Culverts and Bridges	40
9—Reconnaissance and Surveys	48
Explosives	53
Section 803, Blasting (Continued from page 64 of ROADS AND STREETS for December, 1942)	
Post War Construction	58
Statements from State Highway Officials Regarding Their Plans for Highway Work after the War is Over	
Editorial	68
Tests on Soil Stabilized with Asphalt	72
Engineering in Civilian Defense	74
Construction Equipment Maintenance	77
"Keep Every Machine Going!"—Wayne County's	
Shop Order	78
Hints on Emergency Shovel Repairs	82
Casting Lugs on Ends of Wire Rope	84
Cast Iron Motor Block Repair	85
Reclaiming Worn Sheaves	86
New Equipment and Materials	90
Coronach	93
With the Manufacturers	94

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TECHNICAL BOOKS

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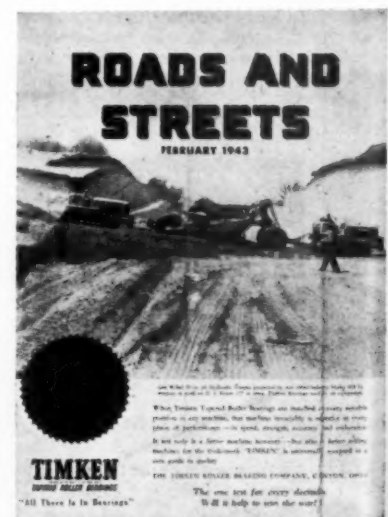
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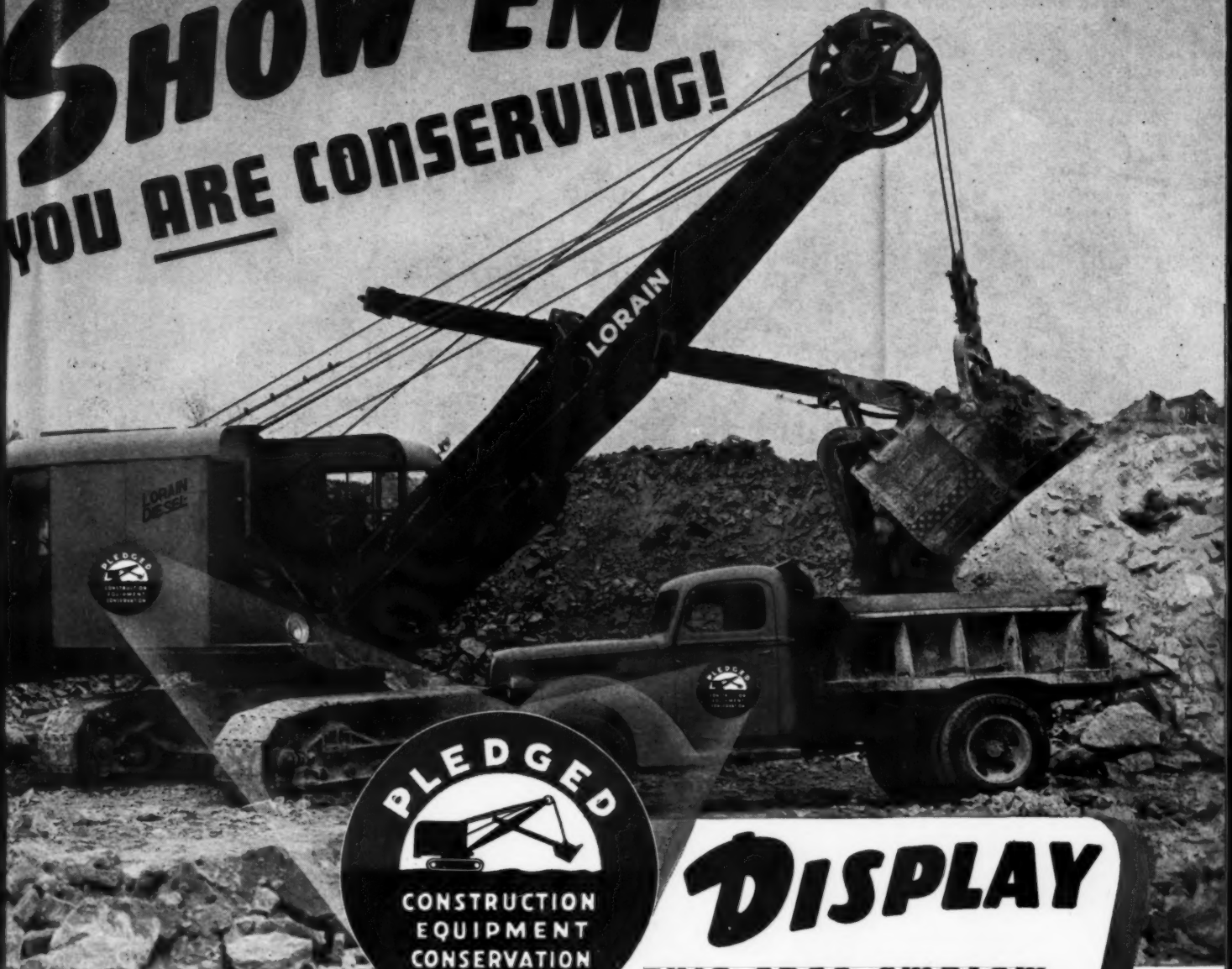
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Operate
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THI
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DRAG

SHOW 'EM YOU ARE CONSERVING!



DISPLAY

THIS FREE EMBLEM

(Actual size 5" in diameter)

Important . . .

Operators of all types and makes of equipment are welcome to send for the same red, white and blue emblem. Easy to apply on metal, glass or wood. Nothing to sign except your name and address on a post card addressed to us.

● It's only a red, white and blue sticker but it means a lot to Uncle Sam's war effort because it shows that these operators are conserving their particular construction equipment—making it last longer and work faster, with all the means and experience at their control.

Doesn't make any difference what you run—shovel, bulldozer, tractor, scraper or truck—there's one of these colorful 5" emblems for you. Just send your name and address and say that you want to show others that you are conserving.

**24-Pages of HOW-TO-KEEP-
'EM-ON-THE-JOB Ideas**

Want some practical ideas on how to make quick, emergency repairs; on how to temporarily substitute for critical, hard-to-get parts and materials? Then write for this new Fix-It Handbook. It will help you salvage and conserve worn parts and will save you time and money, too.

THE THEW SHOVEL COMPANY
LORAIN, OHIO

THEW-LORAIN

**CRANES • SHOVELS
DRAGLINES • MOTO-CRANES**





GALION

TANDEM ROLLER

MOTOR GRADERS • ROAD ROLLERS • SPREADERS

THE GALION IRON WORKS & MFG. CO.

Main Office and Works: GALION, OHIO

MORE THAN A MILLION MILES.. and Still Rolling



KEEPING TRUCKS IN ACTION...NOW OR IN NORMAL TIMES...DEMANDS THE BASIC QUALITY THAT MAKES THIS KIND OF PERFORMANCE POSSIBLE

Veteran of more than a million miles—and still "on the road" making it's regular hauls—that's the service record of this FWD, owned by Clintonville Transfer Line, Clintonville, Wis. Built in 1933, it has performed continuously since, and is now powered by its third engine—with better than 400,000 miles on each of two previous engines.

This is another of many case histories in the FWD files all testifying to FWD's quality and capacity to haul longer for less—in normal

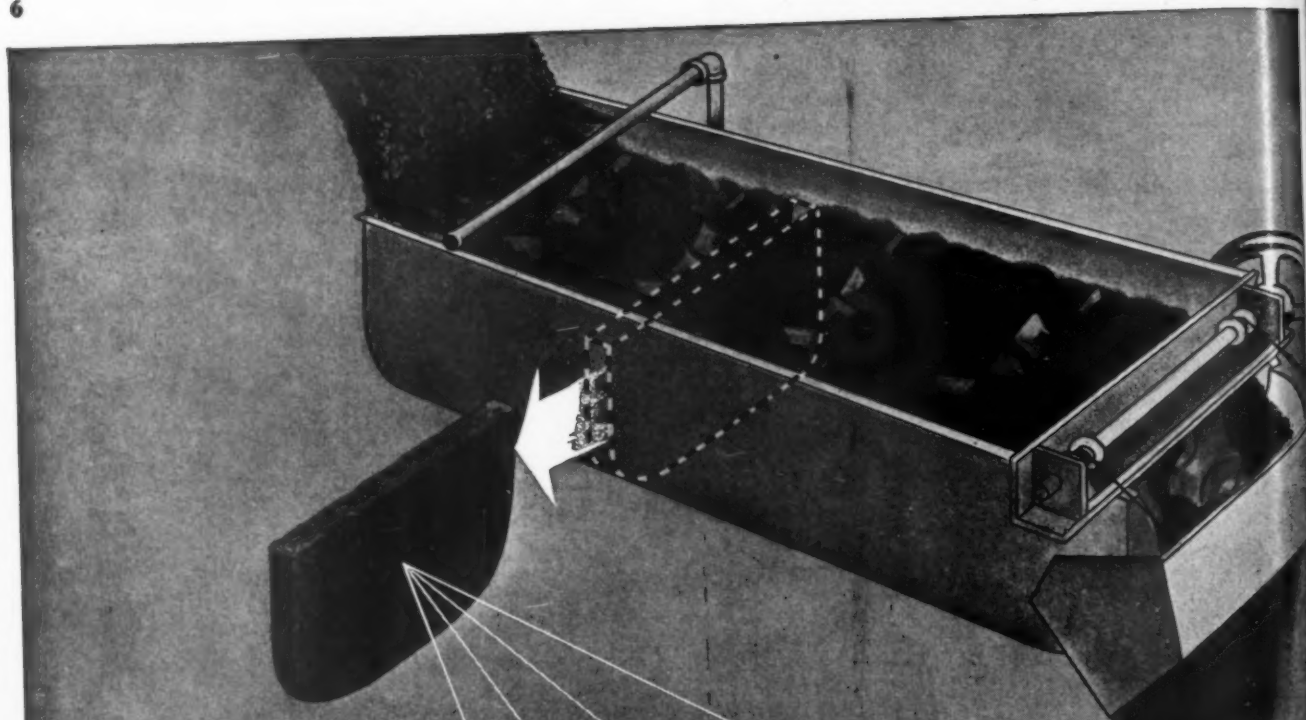
as well as unusual times—in motor transport, highway service, public utility, oil fields, and other services demanding unusual truck performance. And now when wartime truck operation demands every last mile, FWD owners have the advantage of basic, high quality design and construction inherent in FWD's true application of the four-wheel-drive principle.

*Keep Your FWD's Rolling—
No Matter How Old—
With FWD Service*



THE FOUR WHEEL DRIVE AUTO COMPANY

CLINTONVILLE, WISCONSIN • Canadian Factory: Kitchener, Ont., Can.



Continuous Mixing

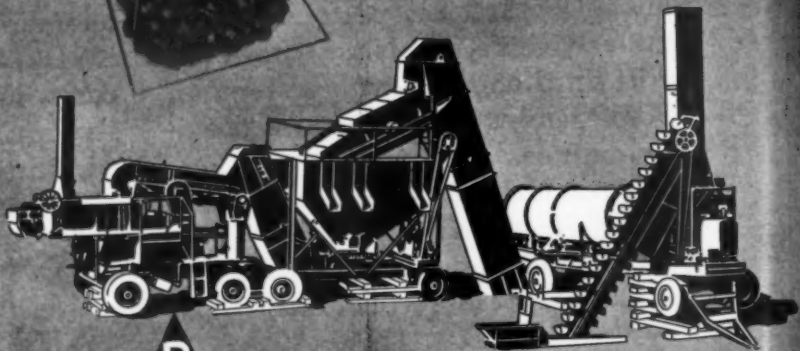
Why did Barber-Greene build a continuous mixer instead of the conventional intermittent batch type? The answer is in the diagram of the Barber-Greene shown above. At the upper left, the graded, and accurately measured aggregate continuously enters the pugmill in a small stream. In entering, it falls through the spray chamber where it is continuously sprayed with a small stream of metered bitumen. The combining process has started, even before the materials enter the pugmill. The need for preliminary dry mixing is completely eliminated. The Barber-Greene does not have to undo the segregation caused by dumping batches into the mill. In fact a cross section of the mix extracted just a few inches beyond the charging end of the pugmill contains the correct amount of each size of aggregate with the correct ratio of bitumen.

Here the propelling and retarding paddles work the material through the pugmill under pressure, using friction to take the excess from the fines and evenly coat the coarse material.

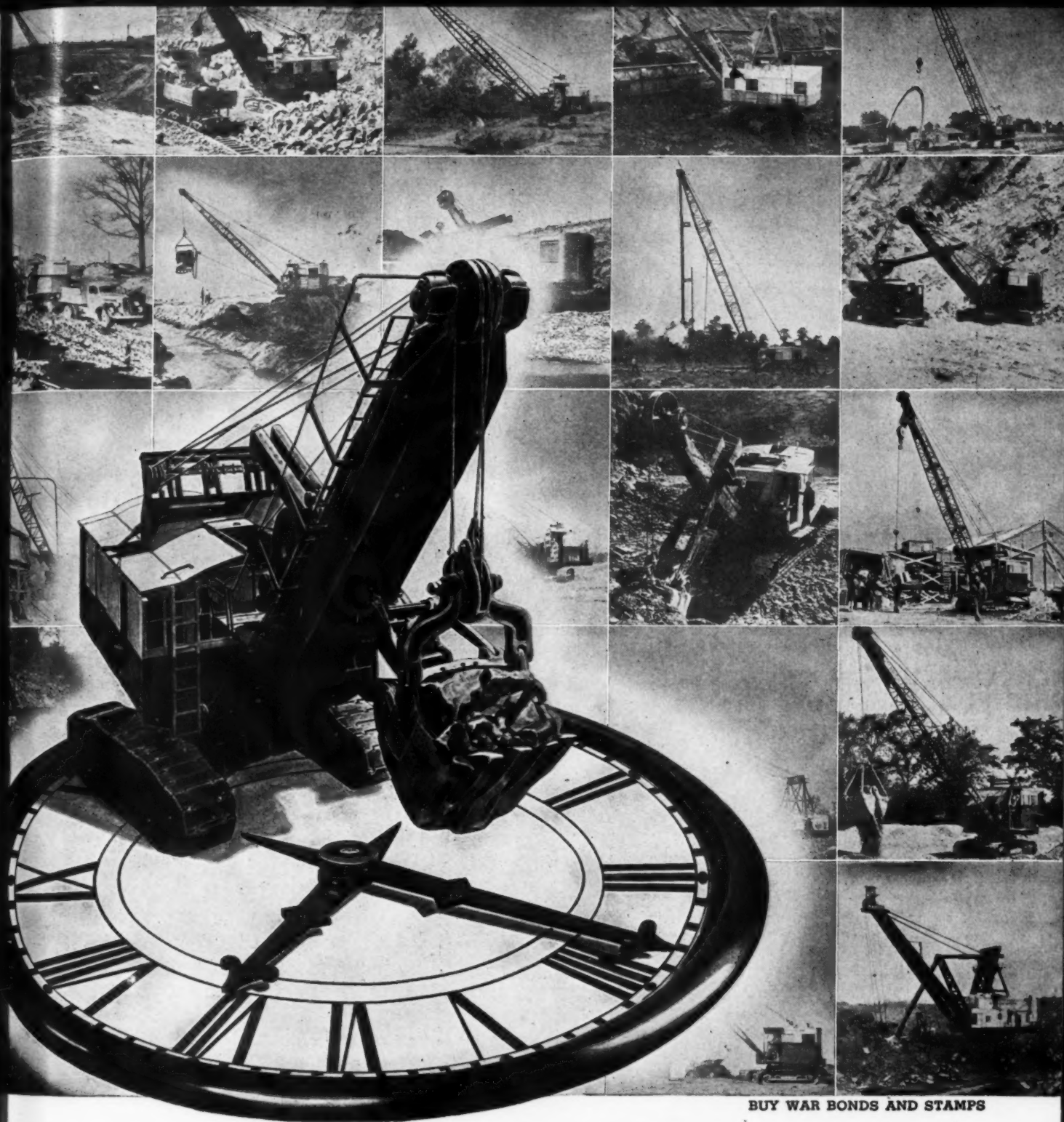
"As the mix is constantly worked through (from left to right in diagram) there can be no dead material, even at the very bottom.

The Barber-Greene uses more horse-sense, and less horse-power. It attains complete homogeneity the easiest, most logical way. It has not only established new standards for accuracy and uniformity, — but has changed moving and erection from a major project to a simple low-cost maneuver. Barber-Greene Company, Aurora, Illinois.

42-1




BARBER GREENE



BUY WAR BONDS AND STAMPS

Every Time The Clock Ticks... Hundreds of MARIONS Swing Into Action

 Fighting fronts are geared to the home front where hundreds of MARIONS make every second count, digging and handling thousands of tons of critical raw materials for our mighty war machine. When the first shot was fired, MARIONS accepted this production challenge and have been on the offensive ever since. It is upon such dependable performance and tireless effort that second fronts and Victory are built.

MARION

**SHOVELS • DRAGLINES • BUCKETS
CRANES • PORTAL CRANES • WALKERS**

WORKING FOR VICTORY: DIGGING — Coal • Magnesium
Iron Ore • Copper Ore • Bauxite • Manganese • Nickel
Molybdenum • Sand & Gravel • Clay

MATERIAL HANDLING — Shipbuilding and Cargo Loading
BUILDING — Airports, Ordnance Plants, Arsenal, Army
Camp, Marine Bases, etc.

3,140,000

The equal of a 20 ft. highway from



San Francisco

HERE is a record to shoot at
—3,140,000 tons for the year 1942

This is the production of six Cedarapids
Crushing plants operated by the Concrete
Materials and Construction Co. of Cedar Rapids, Iowa.
Here's the equivalent of 3055 miles of 20 ft. highway
from San Francisco to New York, 2½ in. thick —
enough stone to pave four Alcan Highways!

Getting things done is what counts today, and out
of today's performance comes the guidance to the selec-
tion of machinery that is going to assure a successful
business tomorrow. Cedarapids Equipment brings you
the advantages that will help you meet competition
after the "Duration."

Cedarapids plants can be engineered for your aggregate
producing needs. From the great Morok Plant (the
only plant giving Big Production at low cost that is
completely portable) to the smallest screen or crusher,
there is Cedarapids equipment that will fit your future
plans. Learn about Cedarapids equipment now. Come
to Headquarters for aggregate producing equipment.

IOWA MANUFACTURING COMPANY
Cedar Rapids • Iowa



Coa
★
Cedar
Rapids

TONS OF ROCK

Coast to Coast $2\frac{1}{2}$ in. thick



New York

for
**VITAL DEFENSE
PROJECTS**

all produced by one contractor
with

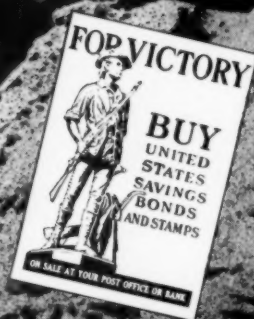
Cedar Rapids MOROK
and PORTABLE PLANTS



Cedar
Rapids



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ROTOTILLER

TRADE MARK REG. U.S. PAT. OFF.

ROADMAKER



**Builds HIGHWAYS,
AIRPORT RUNWAYS,
LANDING STRIPS**
faster, better, more
economically.

**WET or DRY, the 4 speed "3-in-1
Rotary Action" gives a BETTER,
MORE UNIFORM PULVERIZED MIX**

These are days of fast construction schedules and labor shortages. Roadway contractors and airport construction engineers want road-building machines that give superior performance. In the early days of soil-cement construction, back in '37, the FIRST soil-cement areas and roads constructed were made with ROTOTILLER. One of the first airport runways constructed with this revolutionary "3-in-1 rotary action" machine was praised by pilots as "the smoothest runway we ever came in on". It is noteworthy that these and similar pioneer soil-cement jobs were built with early ROTOTILLER models; 1943 models are even better and incorporate practical improvements suggested by contractors themselves.

Today, more and more soil-cement and stabilization work on highways, landing strips, airport runways, and landing fields is being done. ROTOTILLER Roadmaker with its patented, perfected "3-in-1 rotary action" assures more accurate control in wet and dry mixing, as well as more thorough pulverization of materials. The scientific, spring-time rotary action thoroughly mills the earth from top to bottom, resulting in complete pulverization and mixture to any depth up to 10 inches. You get all this in ONE operation—a better job at lower unit cost and with substantial savings in time and labor. Weighs, ready for work, only 3020 pounds—rugged, dependable.

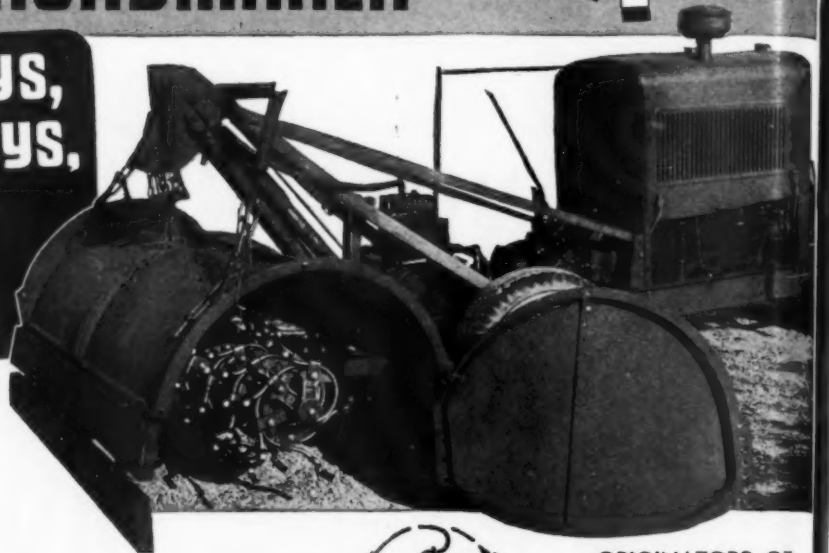
See ROTOTILLER Roadmaker in action and you'll see why road and airport contractors consistently prefer this superior roadbuilder.

AND, AFTER THE WAR . . . Post war reconstruction plans undoubtedly will include the building of thousands of miles of soil-cement and oil stabilized secondary roads. This work will be fostered as a means of giving employment to returning soldiers. Then, as now, ROTOTILLER Roadmakers well be on the job.

Send for Illustrated folder and Technical data.

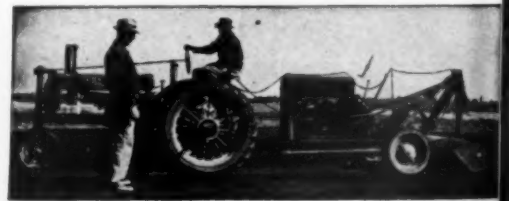
ROTOTILLER, inc. TROY, New York Dept. P

ROADS AND STREETS, February, 1943

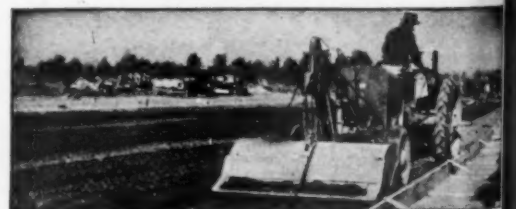


**ORIGINATORS OF
"3-in-1 ROTARY
ACTION" TINES**

Only ROTOTILLER gives you
this 4 speed "3-in-1" mixing
and scarifying combination.



Early model ROTOTILLER building one of the first military airports to use soil-cement. After two hard winters, runways are reported still in first class condition.



With ROTOTILLER Roadmaker mixing can be done close to forms as shown in this illustration. ROTOTILLER can be used with almost any type tractor.



On the job ROTOTILLER saves time, speeds construction by making sharp turns without taking tines from the ground or stopping machine.

MANPOWER

AT A PREMIUM



THAT vital need of the hour—Manpower! As precious as time itself—and as irreplaceable: For years, Michigan Cranes and Shovels have featured Manpower Conservation through the use of easy, fingertip Air Controls, quick-change attachments, simple, trouble-free mechanisms and "truck mobility" with minimum time "between jobs" — more productive time on the job.

And now in the vast construction-for-Victory program, these Michigan advantages are potent factors in helping to solve America's pressing problem of MANPOWER.

Full facts on "Michigans" will be mailed promptly. Request Michigan Shovel-Crane Bulletin RS-23.



MICHIGAN

POWER SHOVEL CO.

BENTON HARBOR, MICHIGAN

ROADS AND STREETS, February, 1943

Lunga Airport,
Guadalcanal
Island
Released
U. S. Navy
Photograph



Here's the Unit for Keeping Airport Runways and Highways in Shape



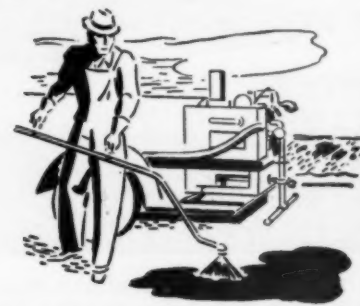
The Littleford Model No. 101 Utility Spray Tank is the versatile Bitumen Spraying Unit for keeping highways and runways in shape.

The No. 101 is three units in one—has Pouring Pot Outlet for crack filling work, the Hand Spray Attachment for patch and shoulder work, and Spray Bar for small application work. Will handle Asphalt, Tar, Emulsion, Road Oil, or Cutback.

For any Black Top Maintenance or Construction Work, the No. 101 can do the job. Made in Two Wheel or Four Wheel Trailers, or Truck Mounted. Write for N-5 Bulletin or see your Littleford Dealer.



Pouring Pot Outlet makes it possible to do crack filling work.



Hand Spray Attachment makes patch work easy.



Spray Bar makes small application jobs, such as shoulder widening, a simple task.



LITTLEFORD BROS., INC. 454 E. Pearl St., Cincinnati, Ohio



Heltzel

CONCRETE CONSTRUCTION EQUIP- MENT . . . PERSONNEL . . . AND MANUFACTURING FACILITIES . . .

Has been dedicated 100 percent to the war effort . . . To the gigantic task of helping to provide our armed forces with better concrete airports, strategic military highways and access roads, munitions dumps, naval bases, training centers, etc. . . ON TIME.

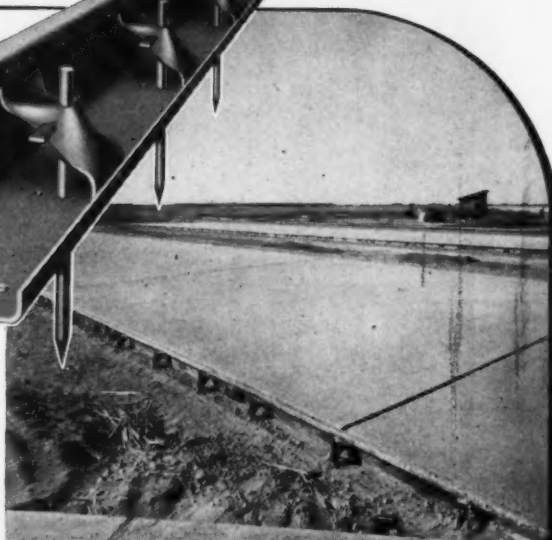
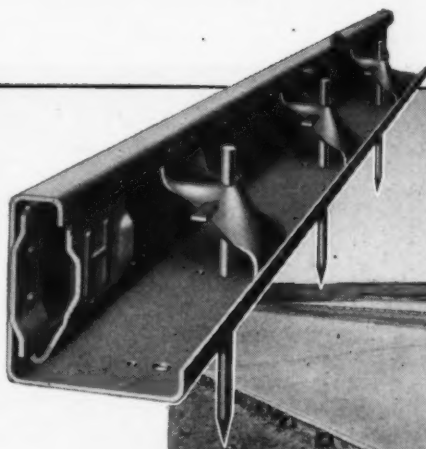
The superiority of Heltzel concrete construction equipment has been demonstrated on our peace-time projects and it is in demand in all parts of the world to help speed up our Victory Program. Our entire production is earmarked for vital war effort construction.

We are in a position to serve you in accordance with government regulations. If your project is vital to the war effort, you can speed up your forming, batching or placing operations with Heltzel equipment.

Write today for complete details.

**ELTZEL SUPERIOR
CONCRETE CONSTRUCTION EQUIPMENT**

MILITARY HIGHWAY FORMS
AIRPORT FORMS
CURB, CURB AND GUTTER OR
DEWALK FORMS
PORTABLE AGGREGATE BATCH-
ING BINS — 30 TO 100 TONS
CAPACITY
PORTABLE AND SEMI-PORTABLE
BULK CEMENT BATCHING BINS
FROM 100 TO 750 BBLs. CAP.
CENTRAL MIXING PLANTS
CEMENT TANKS TO 1500 BBLs.
REMIX CHUTING
CONCRETE FLOOR HOPPERS
CONCRETE BUCKETS



HELTZEL STEEL FORM & IRON CO.
WATERLOO, IOWA, U.S.A.



WARS CAN'T WAIT ON WEATHER!

THAT'S why construction of factory buildings, airport runways, or concrete gun emplacements must continue through cold weather.

True, concrete hardening slows up as temperatures drop, but you can compensate for this natural slowness by adding calcium chloride to portland cement concrete. Engineers recognize this value and specify calcium chloride for speed and safety in concrete construction.

Reports of tests made at the National Bureau of Standards and other data, practical methods, etc., are contained in the new manual, "Early Strength Concrete." Write now for Bulletin 28 to the Calcium Chloride Association, 4145 Penobscot Building, Detroit, Michigan.

Adjust Yourself to Victory

To keep your excavator operating efficiently over the longest possible period, adjustments must be made promptly. A dragging clutch not only wears out its band too soon, but it steals power, and may result in unnecessary stresses throughout the parts functioning in the operating cycle.

Improper adjustments may not show up at once in output figures because a skillful operator can often compensate for them. In the long run, however, repair costs and delays resulting from poor adjustments will cut output and increase costs.

The time required to keep all parts of your excavator adjusted correctly will be more than repaid in decreased power consumption and lower maintenance costs.

Follow your manufacturer's recommendations for care and maintenance carefully and you will keep your excavator going at top speed for Uncle Sam.

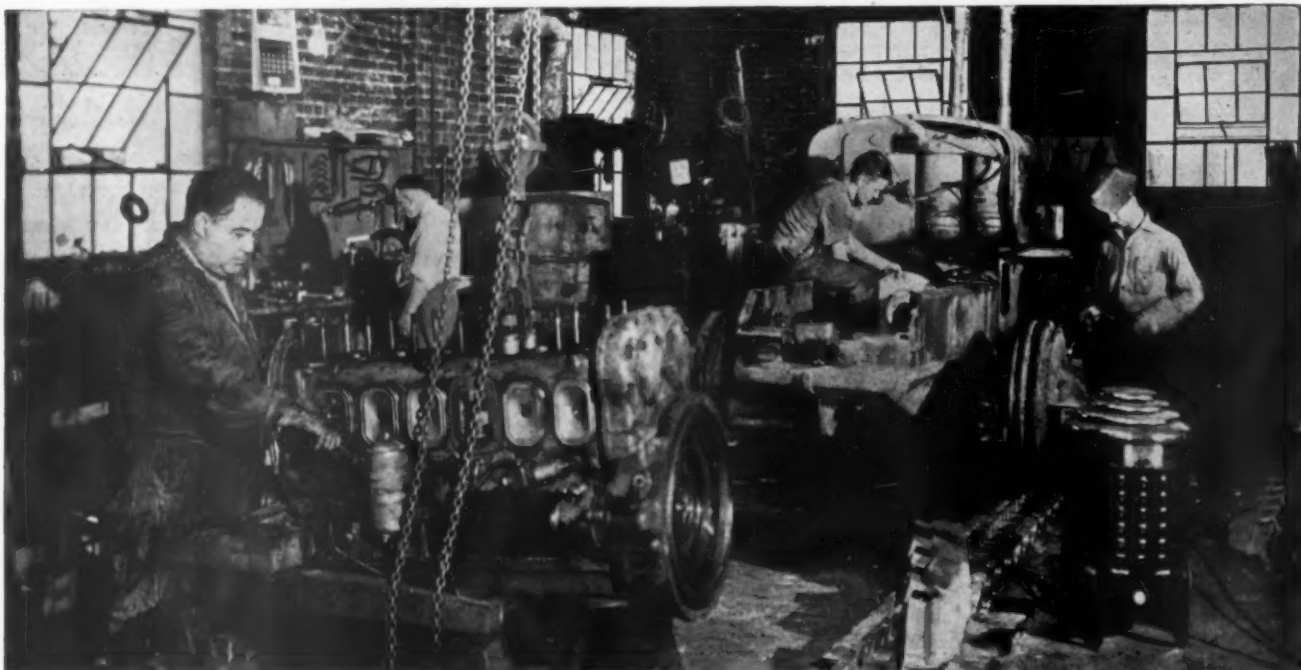


Bucyrus-Erie employees have accepted the award of the Army-Navy "E" as a challenge to keep production rising. * *

Bucyrus-Erie

S O U T H M I L W A U K E E + W I S C O N S I N + U . S . A .

A New, Faster, Better Service Plan



EQUIPMENT OWNERS FIND IT PAYS TO HAUL 'EM IN FOR REPAIRS...

Here is a new service plan — of far more benefit to equipment owners. Instead of having dealer mechanics travel to the job to make repairs. . . it's proved to be much better, faster, more economical to haul your outfits to the dealer's shop. Working in comfort, with warm fingers, proper illumination and the right tools, dealer mechanics find they are able to do more justice to a job, and do it quicker. They have the supervision and expert help of the shop foreman — every problem is quickly solved. Parts go farther — worn out or broken sections are fixed up where possible . . . easily, quickly replaced where necessary. Special tools are available to speed the job — clean surroundings assure proper handling of delicate Diesel parts. In addition, the owner's operators who bring in the machines, work with the mechanics . . . thereby help cut the cost of the work and learn plenty about the care and maintenance of the outfits.

The cost of transporting the machines is surprisingly small . . . and usually they are back on the job sooner . . . ready to work longer. Find out for yourself how well you will like this shop plan. Next time your units need repairing . . . haul 'em into your Allis-Chalmers dealer. He's equipped to do your work right, fast and at bigger savings!

HOW THE SHOP PLAN IS WORKING OUT IN ONE TERRITORY!

"It is surprising how much better the customer has been satisfied and how little it costs to transport the tractor to and from our shop. We are turning out more tractors . . . do a better job . . . get better acquainted with the owners and operators," says Walling Tractor & Equipment Co., Allis-Chalmers dealer at Portland, Ore.



ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE, U.S.A.



WARTIME SERVICE FROM YOUR ALLIS-CHALMERS DEALER

1. **PARTS ASSISTANCE** — Information on availability of parts and how to obtain them.
2. **PRIORITY ASSISTANCE** — Who can get new equipment and how! Up-to-date information on latest regulations.
3. **LIMITATION ORDERS** — Interpretation of latest government limitation orders affecting construction equipment.
4. **SUBCONTRACT INFORMATION** — Frequently dealers possess information on subcontract opportunities.
5. **REBUILDING FACILITIES** — Enlarged, modern shop facilities to handle rebuilding with speed and efficiency.
6. **SERVICE EDUCATION** — Instructions on how to operate and service equipment correctly. Provides service school instructors.
7. **REPAIRS AND MAINTENANCE** — Quick, efficient repairing by skilled, factory-trained mechanics, using the right tools and genuine parts.
8. **USED EQUIPMENT** — In some instances, good rebuilt equipment may be available.
9. **RENTALS** — Good used equipment may be available for temporary emergencies.
10. **EQUIPMENT EXCHANGE** — Information center on used equipment available in territory.

It was **ADNUN**

... that introduced
**LEVELING
WITHOUT FORMS**



*Always
rolls out
smooth as Silk*

Built by the Builders
of
**MULTIFOOTE
CONCRETE PAVERS**

ADNUN

TRADE MARK REGISTERED

BLACK TOP PAVER

WELL over ten years ago and
six years before any other

black top paver had been put on the market, the Foote Company developed "Continuous Course Correction" and "leveling without forms." To date no one has improved on this method of correcting inequalities from the standpoint of smoothness of surface, or simplicity and ruggedness of machine design.

Adnun "Continuous Course Correction" corrects the inequalities and irregularities with a minimum of rough grade preparation and without the bringing up of excessive fats.

In planning for the future remember this Adnun advantage. We'll be glad to give you further details.

THE FOOTE COMPANY, INC., Nunda, N.Y.

*The World's Largest Exclusive Manufacturers of Concrete
and Black Top Pavers*

LATE WINTER STORMS

*are often the **WORST!***

It's Never
"Too Late in
the Season"
for

Walter Snow Fighters



SOME of the worst blizzards of recent years have come late in March. But communities equipped with Walter Snow Fighters have *always in readiness* the most efficient units known for bucking heavy snows and deep drifts, scraping hard-packed snow and ice, or handling other end-of-the-winter conditions. And when winter's over, the same Walter Truck becomes a "handy man" for spring chores like scraping unimproved roads after a rainstorm, excavating for road construction, emergencies, or other heavy hauling tasks incident to road maintenance.

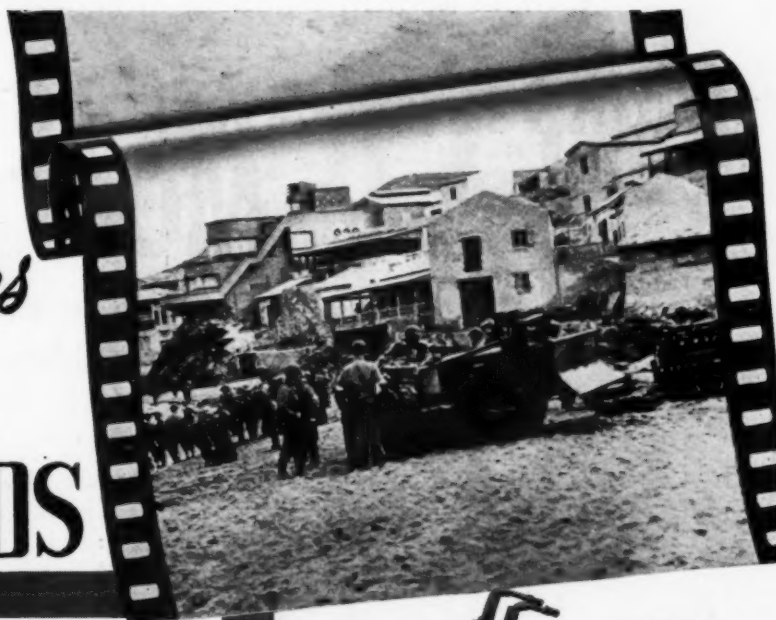
Tremendous power-plus-traction enable Walter Tractor Trucks to keep going under the toughest conditions. Three automatic lock differentials proportion power to each wheel according to its traction at any instant. No wheel shirks, every wheel works, on snow, ice, dirt, mud, grades and other difficult running conditions. Suspended Double Reduction Drive, Tractor-Type Transmission and other exclusive features contribute further to the unfailing service of Walter Tractor Trucks in rough going. Write for full information regarding Walter 4-Point Positive Drive.

WALTER MOTOR TRUCK CO.

1001-19 Irving Ave., Ridgewood, Queens, L. I., N. Y.



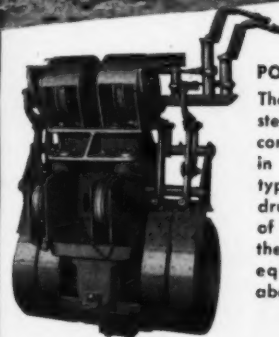
GOOD NEWS *for tomorrow's equipment users from today's* BATTLEFIELDS



IN this mechanized war, Buckeye tractor equipment has become battle-front equipment . . . serving under every conceivable condition, undergoing punishment that puts every part, every feature to the most gruelling test—punishment that no peacetime construction job could possibly equal. The invaluable experience of this world-wide "field test" has not only helped create the better "fighting tools" we need for victory, but also holds the promise of more efficient, faster-working, longer-lasting equipment that will make the building of our new peacetime world facilities an easier, faster and cheaper job.

BUCKEYE TRACTION DITCHER CO., Findlay, Ohio

*For real help in meeting today's problems,
in planning for tomorrow's big job—keep
in touch with your Buckeye distributor!*



BUCKEYE POWER CONTROL WINCHES

These fast, rugged winches step up output from all cable-controlled equipment. Made in medium and heavy-duty types, single and double drum models to fit all makes of crawler tractors. To get the most out of tractors and equipment, get the facts about these output-builders write for information now!



BUCKEYE BULLDOZERS & TRAILBUILDERS

Every practical feature to make tractor power produce the most is provided in these modern dirt-movers. Balanced weight maintains full crawler contact with the ground for better traction; engineered blade curvature steps up dirt moving ability and saves power. You'll find many other time and money-saving features—write for complete data.



Built by Buckeye

Convertible Shovels



Trenchers



Tractor Equipment



R-B Finegraders



Road Wideners



Spreaders



Make Haste without Waste with MONOTUBES

...the job-proven method of installing foundations faster, safer, and at less cost



The use of all-steel tapered Monotubes is a proven, practical method of installing cast-in-place concrete piles that meets all engineering requirements while assuring you important economies.

Consider these special Monotube features:

- 1 SPEEDY Handling**—Monotube steel casings are light in weight for fast and economical handling.
- 2 SPEEDY Driving**—Monotubes are so strong and rigid they require no heavy core or mandrel and can be driven with average job equipment.
- 3 SPEEDY Extension**—The use of extendible Monotubes permits installation of varying pile lengths without delay or waste—even in low headroom.
- 4 SPEEDY Inspection**—The hollow tubular design of Monotubes enables you to inspect these casings quickly and thoroughly from top to toe prior to concreting.

Monotubes, made only by Union Metal, are available in a wide range of gauges, sizes, and tapers to meet the most exacting requirements in any soil condition. Write for your copy of the Monotube Catalog 68A which gives additional valuable information.

*Remember "More Production
means Axis Destruction"*

The **UNION METAL** Manufacturing Co.
CANTON, OHIO





A BOY COMES HOME

REMEMBER how he used to come home?

There'd be the slam of a car door in the dusk. "So long, Joe, see you tomorrow." Then the swift, light footfalls brushing the leaves on the walk, the thud as 160 pounds of wiry muscle hit the porch in an easy bound that ignored the existence of steps . . . the crash of the front door, rattling every picture in the house, and the newly baritone voice calling, "Hey, Mom, when do we eat?"

Remember?

Now, a Marine flyer, he comes thundering in to Guadalcanal in the last light, the wind howling through the new hole in the fuselage where a chunk of shell just missed. The bomb racks are empty and, miles away on the darkening water, a Jap officer volleys desperate orders from the bridge of a destroyer that will never see Yokohama again.

Below, as his plane circles, American guns are still pounding away, winking and flashing in the twilight. On the flying field the crawling tractors and their sweaty drivers are at their endless task, filling fresh shell holes and bomb craters, making a safe surface for him. Back and forth the tractors go, up and down, looking from this height like friendly beetles, each rolling a ball of earth ahead of it. He is conscious of relief. That strip hadn't looked too good when he took off.

He loses altitude now, the ground comes up with a rush and the wheels touch and cling. He climbs stiffly down and a voice says from the gloom, "You're late, pal. Nothing minor, I hope?" He grins. Bill must have waited around, the worry-wart. What he says is, "Okay, here. Did you wolves by some mischance leave anything to eat?"

He's back at his home port again—and safe!

★ ★ ★

To make his homecoming safe, the rugged International tractors which the Marines took to Guadalcanal have worked unceasingly throughout that wild fight. Under every adverse condition, the tractors have kept going, their performance a tribute to the determined men and women who built them.

We take it to be our job, and the only job of the many machines and weapons we make for Army, Navy, and Marines, to do our best to see that every American fighting man comes home—AND COMES VICTORIOUS.

INTERNATIONAL HARVESTER COMPANY
180 NORTH MICHIGAN AVENUE, CHICAGO, ILLINOIS

INTERNATIONAL HARVESTER

BUY
MORE

BUY
MORE



No. 1 of a series of advertisements in the interests of national economy to aid users of crushing equipment unable to secure new units during the emergency.

Proper Feeding of Materials

Avoid feeding stone that is too large for the crusher opening as it is certain to increase wear and cut production. As long as a large rock chokes the mouth of the crusher, no new material can be fed and an empty crusher is non-productive. Avoid dumping directly into crusher mouth as big rocks may be in the load to choke and damage equipment and its removal is a slow, tedious job.

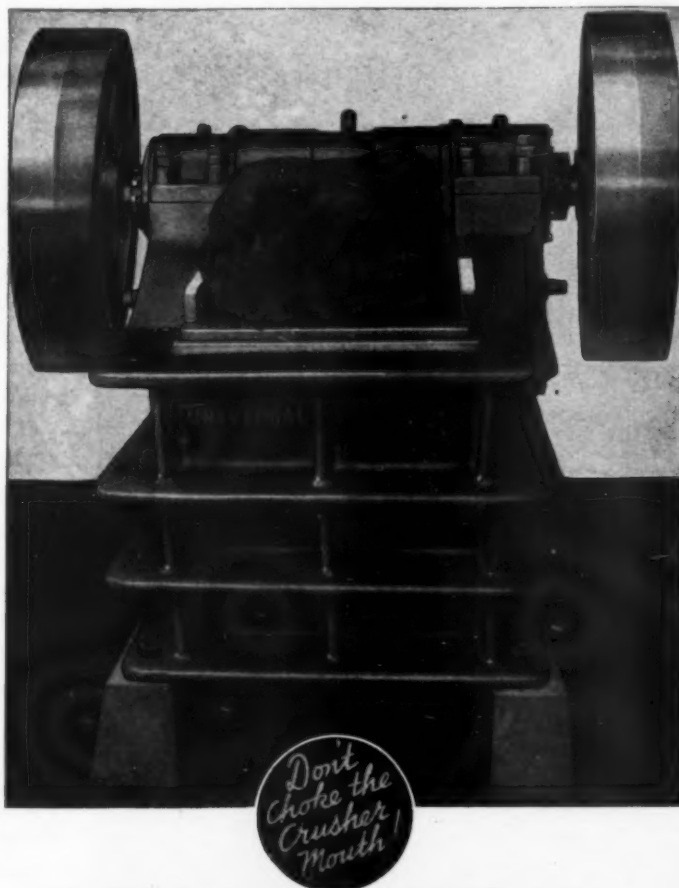
Don't ever use a sledge hammer to break a large rock in the crusher while it is running. An accident with the sledge might easily result in serious damage to the crusher. It is much safer to stop the crusher. Better still—be sure all rock is reduced to the proper size before bringing it up to the crusher.

Use a dump box or ramp for handling incoming material, feeding by rake or shovels and breaking pieces too large for feed by hand. Of course, an apron or conveyor feeder dumping onto a grizzly or screen is preferred because it provides a steady feed and allows for by-passing fines, lessening the amount of material going through the crusher, reducing wear and increasing plant capacity.

Removal of excess clay avoids packing of the crusher jaws and slippage. Removal of tramp

iron in the field or on the conveyor avoids costly breakdowns.

Universal Crushers and Crushing Plants are built for long time trouble-free service—proper care and maintenance will greatly extend their useful service life.



UNIVERSAL ENGINEERING CORP.

Formerly the Universal Crusher Company
631 C Avenue West,
Cedar Rapids, Iowa

UNIVERSAL

CRUSHERS, PULVERIZERS, COMPLETE PLANTS, SPREADEROLLERS, PORTABLE ASPHALT PLANTS



OSGOOD

recommends the continued
purchase of War Bonds and
Stamps — and the observance
of preventative maintenance
to keep your machinery run-
ning.

OSGOOD AIR CONTROL

the smooth, velvety, effortless control force with
the operating ease and efficiency of steam.
OSGOOD Air Control is simple in operation, easy
to maintain, and costs next to nothing.

The
GENERAL
EXCAVATOR CO.

Sizes: 3-12-58-34
DIESEL - GAS - ELECTRIC

Associated with
THE OSGOOD CO.

The
HERCULES
COMPANY

HERCULES
IRONEROLLERS
6 to 12 Tons
Diesel or Gasoline

Associated with
THE OSGOOD CO.

OSGOOD

Sizes:

1/2 to 2 1/2 Cu. Yd.

Diesel - Oil - Gas - Electric

THE OSGOOD COMPANY, Marion, Ohio



SHOVELS

DRAGLINES - CRANES

Crawler & Wheel Mounted

Patent Rights

Date	Number
8-14-28	1,680,923
6-11-29	1,716,872
2-11-30	1,746,570
4-7-31	1,799,269
11-10-31	1,831,153
2-20-40	2,190,748

Also Foreign Patents



Trade Mark

"First Call on Defense Jobs"

Patent Rights

Date	Number
6-1-27	1,586,991
4-24-28	1,667,253
3-29-32	1,851,339
4-24-28	1,667,252
10-7-29	Re.17,452
7-21-36	2,048,151

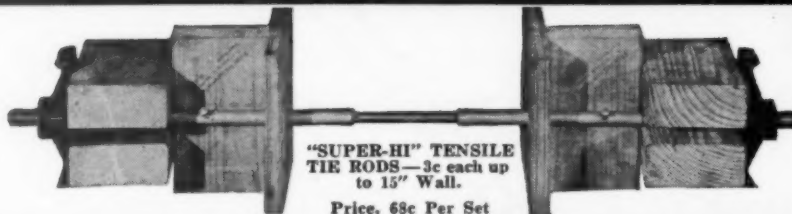
Other Patents Pending

WILLIAMS "SIMPLEX" CLAMPS

For Commercial Buildings, Sewage-Disposal Plants, Filtration Plants, Architectural Concrete, Etc.

World's Largest
Office Building
Uses
Williams "Simplex"

Our War Dept.
Headquarters



"SUPER-HI" TENSILE
TIE RODS—3c each up
to 15" Wall.

Price, 68c Per Set

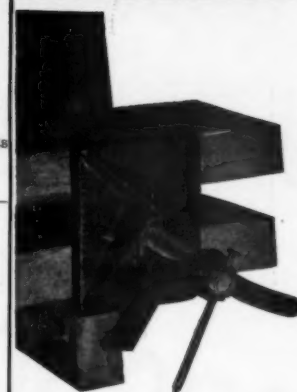
OK'd By
Engineers

(Not a "Hay Wire" Tie)
7200 Lbs. Working
Load. 9000 Lbs.
Ultimate at the
Cost of No. 9 Wire.

NO "BREAK OFF LOSS" WITH WILLIAMS TIES**WILLIAMS "VIBRA-LOCK" CLAMPS**

For Dams, Bridges, Heavy Construction, Battered Walls, etc.

Number	For Inner Rod Size	Acme Thd Waler Rod Length	Bracket Size	Ordinary Mild Steel Maximum Allowable Working Load to Elastic Limit (Not Used)	USING WILLIAMS HIGH TENSILE RODS		Price Per Set 2 Waler Rods 2 Wing Nuts 2 Brackets
					Tensile Strength Ultimate	Maximum Allowable Working Load to Limit	
US-VL-1	3/8"	18"	(B-2) 3 1/2"x5"	1,800 Lbs.	9,000 Lbs.	7,200 Lbs.	\$1.25*
US-VL-2	3/8"	24"	(B-2) 3 1/2"x5"	1,800 Lbs.	9,000 Lbs.	7,200 Lbs.	1.38
US-VL-3	3/8"	30"	(B-2) 3 1/2"x5"	1,800 Lbs.	9,000 Lbs.	7,200 Lbs.	1.50
US-VL-4	3/8"	36"	(B-2) 3 1/2"x5"	1,800 Lbs.	9,000 Lbs.	7,200 Lbs.	1.60
US-VL-5	1/2"	20"	(B-3) 4"x5"	3,200 Lbs.	16,000 Lbs.	12,800 Lbs.	1.55*
US-VL-6	1/2"	20"	(B-4) 5"x6"	3,200 Lbs.	16,000 Lbs.	12,800 Lbs.	1.65
US-VL-7	1/2"	24"	(B-3) 4"x5"	3,200 Lbs.	16,000 Lbs.	12,800 Lbs.	1.65
US-VL-8	1/2"	24"	(B-4) 5"x6"	3,200 Lbs.	16,000 Lbs.	12,800 Lbs.	1.75
US-VL-9	1/2"	30"	(B-4) 5"x6"	3,200 Lbs.	16,000 Lbs.	12,800 Lbs.	1.90
US-VL-10	1/2"	36"	(B-4) 5"x6"	3,200 Lbs.	16,000 Lbs.	12,800 Lbs.	2.05

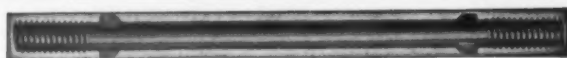


WM.'S VIBRA-LOCK
CLAMP REMOVAL

Locked to Waler Rod by 20 or 30 penny Spike engaging slot in rear of Wing Nut and cross drill in Waler Rod.

WILLIAMS "SUPER-HI" TENSILE TIE RODS
INEXPENSIVE U. S. STANDARD THREAD RODS

(Elastic Limit or Working Load
4 Times as High as Mild Steel)

**WILLIAMS WALER SUPPORTS**

3/8" diam. U. S. — 16 thd.			1/2" Diam. U. S. — 13 thd.		
9,500 lbs. Ultimate Tensile 7,500 lbs. Working Load per Rod			16,500 lbs. Ultimate Tensile 13,000 lbs. Working Load per Rod		
LENGTH of Rod	Price per 100 Rods	App. Wall Width	LENGTH of Rod	Price per 100 Rods	App. Wall Width
12" or less	\$3.00*	15" or less	12" or less	\$4.00*	15" or less
13"	3.25	16"	13"	4.33	16"
14"	3.50	17"	14"	4.67	17"
15"	3.75	18"	15"	5.00	18"
16"	4.00	19"	16"	5.33	19"
17"	4.25	20"	17"	5.67	20"
18"	4.50	21"	18"	6.00	21"
19"	4.75	22"	19"	6.33	22"
20"	5.00	23"	20"	6.67	23"
21"	5.25	24"	21"	7.00	24"
22"	5.50	25"	22"	7.33	25"
23"	5.75	26"	23"	7.67	26"
24"	6.00	27"	24"	8.00	27"

*Rods under 12" in length knurled to prevent turning in concrete.

Immediate 24-hr. Service

PHONE 3-3823

Day or
Night(Wire or phone Collect on
orders of \$100.00 or more)**WILLIAMS FORM ENGINEERING CORP.**

Box 925, Madison Square Station

GRAND RAPIDS, MICHIGAN

...GET **MORE MILES** OF
HIGH QUALITY PAVING PER DOLLAR
WITH **WOOD ROADMIXER**



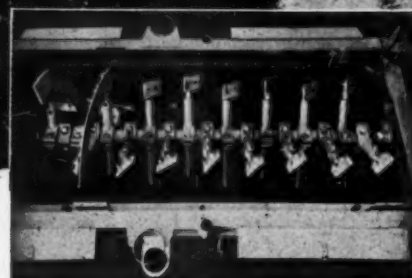
Wood Roadmixers lay more miles of high quality paving per dollar than any other method of pavement construction. The reasons are simple. *First*, Wood Roadmixer employs the traveling plant method of pavement construction—picks up the aggregate, mixes it, and deposits it while the Roadmixer travels at a regulated speed. *Second*, only three pieces of equipment are needed, the Roadmixer, a crawler tractor and a supply truck. Usually the tractor and supply truck are already available. *Third*, two men can handle the entire unit and turn out as much as 2,000 tons of mix in an 8-hour day.

Paving dollars go farther with Wood Road-

mixers. This fact is being proven every day on jobs in this country and abroad. For faster and better pavement construction at less cost, learn all the facts about Wood Roadmixers.

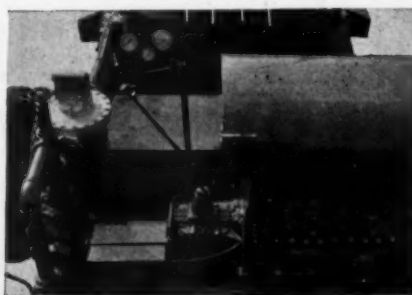


Accurate Pick-up and Proportioning
Roadmixer makes clean pick-up of material, which passes into mixing drum with accurate binder proportioning.



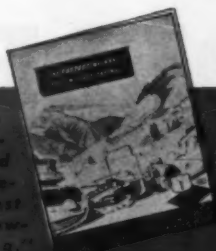
Continuous and Thorough Mixing

One-pass mixing continuously and thoroughly mixes aggregate with binder. Material is discharged at end of drum.



Accurate Binder Volume Control
Liquid binder is delivered to mixing drum through spray nozzles. Volume and pressure are accurately controlled by metering!

Write for detailed and illustrated Wood Roadmixer bulletin, "The Fastest Method of Low-Cost Paving."



WOOD ROADMIXER

Wood Manufacturing Co. • 816 West 5th St., Los Angeles, California

IT'S HUBER'S JOB TO KEEP 'EM FIT!



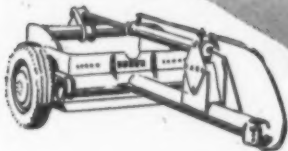
O. W. L. PHOTO



It has always been Huber's job to build and maintain streets and highways and to keep airports as smooth as golf courses. Today it is doing the same efficient job, but with a greater feeling of responsibility . . . for HUBERS are now on military duty . . . working for Uncle Sam and his Allies on a twenty-four hour schedule to provide fast travel for troops and safe landing for bombers. " " " " "

THE HUBER MFG. CO. • MARION, OHIO

HUBER *Automotive Type* ROLLERS



SPEED-SCOOPS • BULLDOZERS



FOR WORK WELL DONE

From the burning sands of Africa to the steaming jungles of Guadalcanal, our fighting men on land and sea are in the thick of battle, clearing the way to Victory.

It is our responsibility here at home to keep vital war supplies rolling in ever increasing volume to these men who are doing such a magnificent job on the world's far-flung battle fronts.

War plants, shipyards, air fields, military highways must be built in record time. Cargo ships must be loaded and unloaded without delay. Such a tremendous task requires cranes, shovels and draglines in great numbers.

Since the bombing of Pearl Harbor, the men and women of the Shovel and Crane Division of Lima Locomotive Works, Incorporated, have been building cranes, shovels and draglines with determination to meet every specification and to exceed every schedule set for them.

As a reward for outstanding accomplishment in the production of war materials, the Army and Navy have conferred upon this division the Army-Navy "E" award. Labor and management are proud of the award and the part they are playing in the battle of production.

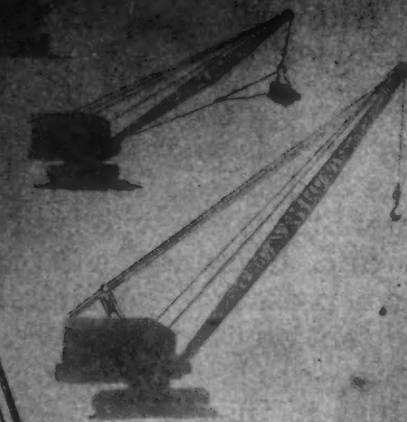
It will continue to be our pledge to build better cranes, shovels and draglines faster until Victory is won.

ARMY

E

NAVY

We are mindful of the fact that without the fine cooperation of our many suppliers who have furnished us with parts and materials, our award of the coveted Army-Navy "E" flag would not have been possible.



Lima Locomotive Works, Incorporated
Shovel and Crane Division
LIMA, OHIO

LIMA

SHOVELS, 1 YD. TO 3 1/2 YDS.

DRAGLINES - VARIABLE

CRANES 13 TONS TO 65 TONS

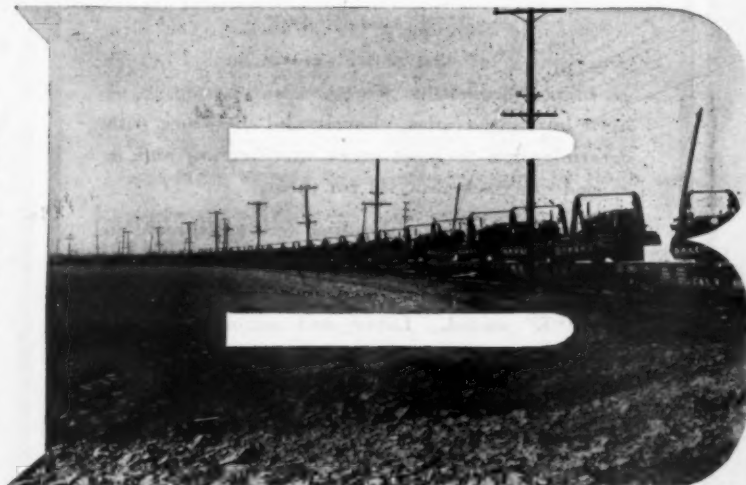


Les Mécaniques Américaines Assurent la Victoire!

★ Yes, these fighting Free Frenchmen know a victor when they see one. They were licked once and they know what it took to do it — and they know we've got mechanization that will make their goose-stepping conquerors say "Uncle."

If you could see those Baker Hydraulic Bulldozers smoothing out North African sand dunes for airports, making camel trails into jeep roads, filling bomb craters at air bases and removing debris in age-old Islam villages before the bomb fragments have had a chance to cool—you, too, would agree, "Victory is in the bag."

This war is more than tanks, guns and ships. On every front, Baker Bulldozers with their direct lift and tremendous hydraulic down pressure—not merely dependent on gravity or weight of blade—are leaving no stone unturned to insure a speedy victory. Send for a copy of "Unsung Heroes of War."



THE BAKER MFG. CO.

506 Stanford Ave.

Springfield, Ill.

Baker Hydraulic Bulldozers and Construction Equipment have gone all-out for global war. Every unit leaving our plants is directly engaged in the war effort. We have evolved wartime production methods that will bring you better Bakers at lower cost after the war.

BAKER

The Modern Tractor Equipment Line
for
EARTH MOVING
LEVELING AND GRADE BUILDING
SNOW REMOVAL
ROAD MAINTENANCE

NO WAR, EVER BEFORE, SAW SHIPS BUILT IN 6 DAYS

...nor the modern *Preformed wire rope*

THAT LIFTS AND SWINGS THEIR PARTS INTO PLACE

New to this war—the ship-building speed records being shattered from day to day.

New to this war, too—the Preformed Wire Rope which is playing such a giant role in the ship-building program; *new to this war*—though tested and proved through years of peacetime production, as if in preparation for the tough wartime tasks ahead.

Tested and proved stronger, longer lasting, more flexible, more easily handled—cutting shutdowns, cutting accidents, cutting costs—Preformed Wire Rope is doing a *front-line* job on hundreds of assignments in ship-building, as well as maintaining its *home-front* job in industry.

Ask your own wire rope manufacturer or supplier

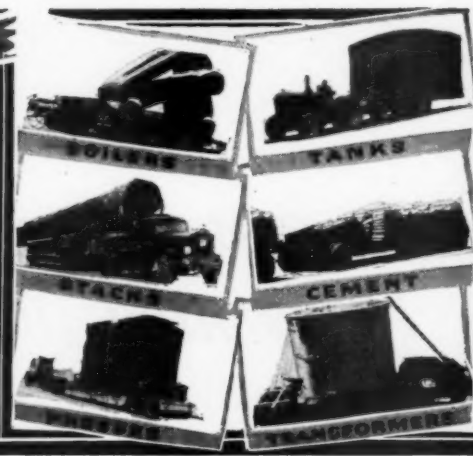


Serving the "FACTORY FRONT" too!

ROGERS

TRAILERS

ROGERS BROTHERS CORP., ALBION, PENNA.



GRUENDLER CRAFTSMANSHIP

Employed by U.S.A. in the WAR EFFORT

For Access Road and Air Base Construction

PORTABLE CRUSHERS

Proper Size Aggregates—on the Job
Balanced, Non-Tipping. Expertly designed to meet your exact requirements in proper size aggregates—larger capacity and quick mobility to and from job.



Four Wheel Maintenance
JAW CRUSHER with
Power Unit

GRUENDLER ENGINEERS

On the job to help you in any way, NOW and for your Post War Plans. Blue Prints or Practical Suggestions sent—No obligation.



Write for . . .
Bulletins and
Illustrated
Catalog No. 601

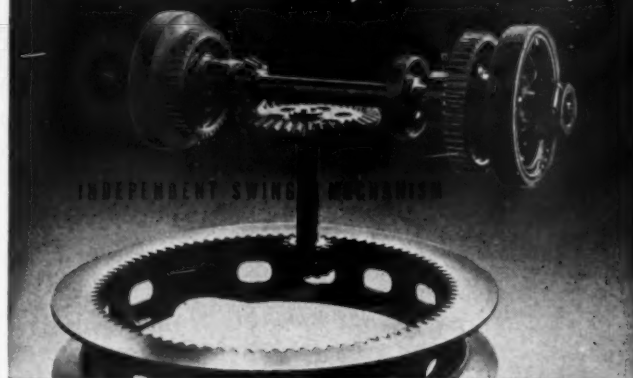
GRUENDLER

ST. LOUIS, U.S.A.

GRUENDLER CRUSHER & PULVERIZER CO.

PLANT and MAIN OFFICE—2915-17 N. MARKET • ST. LOUIS, MO.

Here's why **BYERS** Cranes
can swing at any time
while *Travelling or Steering*



For complete specifications and delivery of any of Byers $\frac{1}{2}$ - $\frac{3}{4}$ - $\frac{1}{2}$ - $\frac{3}{4}$ -yd. gas or diesel power shovels, cranes, draglines or back hoes on crawler or truck mountings, see the nearest Byers sales and service headquarters, or wire factory.

DISTRIBUTORS THROUGHOUT THE WORLD

Specify

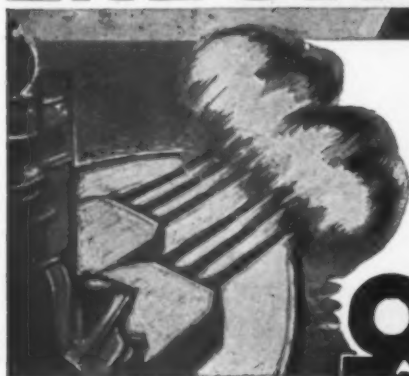
BYERS

CRANES and SHOVELS

RAVENNA, OHIO

DISTRIBUTORS THROUGHOUT THE WORLD

ENDURANCE



IN battle, dogged endurance is essential to victory. In excavating, too, a bucket must not only dig, but continue to dig efficiently under every conceivable condition, for long periods of time. Experience has built into Owen Buckets materials, original features and design factors that assure enduring performance that is unequalled.

THE OWEN BUCKET COMPANY
6070 Breakwater Ave. Cleveland, Ohio
Branches: New York, Chicago, Philadelphia Berkeley, Cal.



OWEN BUCKETS

A MOUTHFUL AT EVERY BITE

ACCURATE SPOTTING *for* FAST LOADING



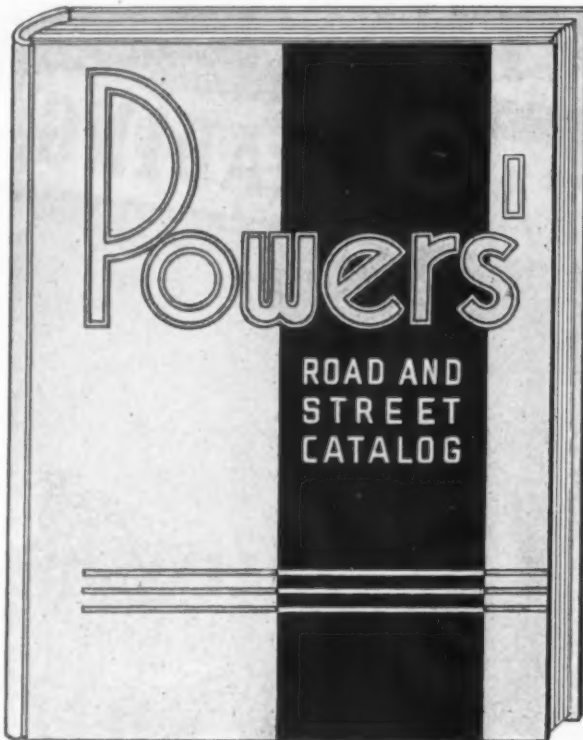
Koehring Shovels Permit Maximum Output Per Shift

With a Koehring Shovel every move is a productive move. Accurate, speedy swing provides ease in spotting for fast loading. The control is so simple and smoothly working that an operator can keep up top production for a full shift without let down. There need be no waste loading time on your hauling equipment if you are using a Koehring. Koehring features include self-cleaning crawlers—all welded construction—positive steering—fast operating speeds—quiet operation.

KOEHRING COMPANY • Milwaukee, Wis.



HEAVY-DUTY CONSTRUCTION EQUIPMENT



**1943
NINETEENTH ANNUAL EDITION**

*Forms nearing completion
Wire for Reservation.*

First Aid!

POWERS' CATALOG Gives First Aid to Many New Buyers in the Highway Field when Seeking Information on Materials and Equipment.

Men now engaged in Highway and Airport Construction and Maintenance as it pertains to National Defense are attached to:

Field Procurement Offices of the War Department

Field Purchasing Offices of the Navy Department

County and Municipal Airports

Offices of the Engineer Corps

Engineering Training Schools

Engineer Replacement Stations

Washington Offices of Army, Navy and Air Corps

Field Offices of the Bureau of Yards and Docks

MILTON E. SENTER, Mechanical Inspector, War Dept., U. S. Army Engineers, says:

"I travel throughout the Pacific Northwest as an inspector of construction equipment for the Division Equipment pool. Everyone operating a machine and those connected with equipment in the offices are interested in your Catalog to familiarize themselves with the types and models. About 60 people use my Catalog."

**JOHN S. ROBAS, Equip. Purchasing Agent for
John A. Johnson Contracting Corp. and Mount Vernon Contracting Corp., writes:**

"I have found this publication to be of immense value in writing specifications and buying and renting equipment. ***** I would appreciate receiving from you, with or without charge as you see fit, back editions of Powers' Road and Street Catalog" for as many years as you can conveniently supply. Please accept my congratulations for your success in turning out a definitely worth-while publication, and my assurance that your assistance is greatly appreciated."

POWERS' CATALOG offers a live file for your 1943 Equipment Story. It is used as a buyer's reference guide by Federal, State, City, and County Officials with purchasing power. New buyers and operators in the Army, Navy and Air Corps are finding the Catalog FIRST AID in helping them with their problems.

Details as to space rates or mechanical requirements sent on request

POWERS' ROAD AND STREET CATALOG

Published by
GILLETTE PUBLISHING COMPANY

**330 South Wells Street
Chicago, Illinois**

This is the new HAISS Model 77 Loader, now in use at the yards of the Gas Purifying Materials Co., Inc., Long Island City, N. Y.

Faster and easier maneuvering . . . with **Magdraulic Electric Brakes**



HAISS never misses a bet to improve the efficiency of their equipment. Their Model 77 Loader is now available with specially equipped MAGDRAULIC Electric Brakes as well as with the conventional manual brake.

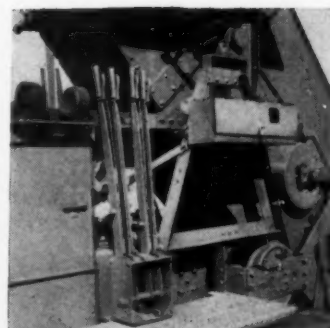
The MAGDRAULIC Electric Brake provides a more powerful braking force, without manual effort, and with it the advantages of quicker action and greater facility in operation and maneuvering. By means of two hand controllers the operator can brake each track individually for quick turns in limited space.

The extraordinary torque of the MAGDRAULIC Electric Brake is developed within the brake itself. It is a

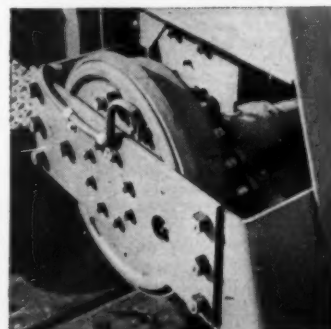
compact, self contained unit, available in several sizes, and adaptable to many braking needs.

Our engineers will gladly consult with you on any braking problems. Complete Data Book available on request. Write at once, to

EMPIRE ELECTRIC BRAKE CO., NEWARK, N. J.

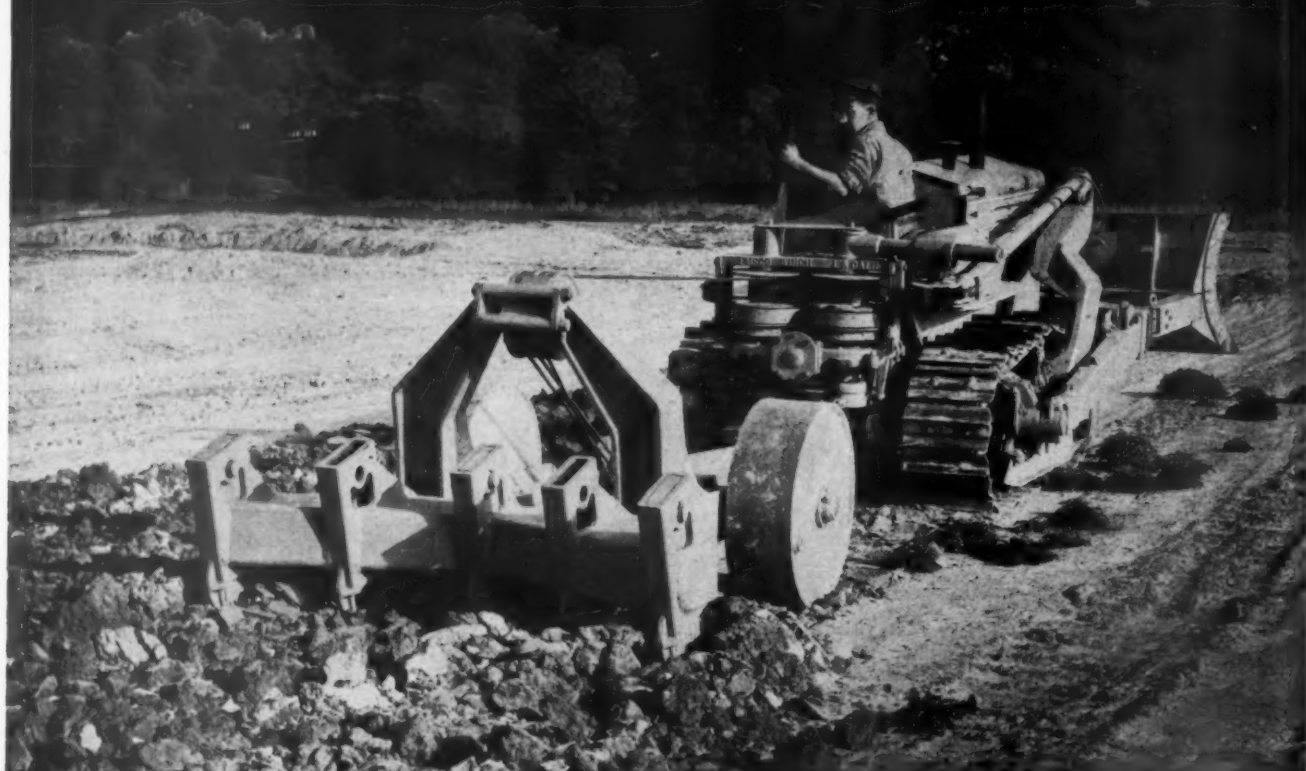


THE NEW MAGDRAULIC Electric Brake is set by electric current, controlled by right and left hand controllers shown above. The operating levers can also be handled by operator from same position.



THE NEW MAGDRAULIC Electric Brake is compact, self-contained and streamlined. Electric force for braking flows in slightly exposed cable. Both right and left hand brake can be independently set by controllers.

POWER...POWER... and **MORE POWER**



...for Victory



TODAY, your Cletracs are weapons of war—even though fighting far behind the battle fronts. It is not only to your own interest to get more hours of efficient and economical service out of your Cletracs, but it also becomes your patriotic duty to conserve this power and to use it effectively.

Wherever you are, your Cletrac dealer is ready to help you get the most out of all your equipment. His facilities for service, the skill of his trained mechanics, and his ability to secure repair parts are at your command. Seek his help in making your Cletrac power contribute the utmost possible for Victory.

THE CLEVELAND TRACTOR COMPANY • CLEVELAND, OHIO

Cletrac Crawler Tractors

GASOLINE AND DIESEL



ROADS AND STREETS

February, 1943, Vol. 86, No. 2



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The large size of this project and the construction methods used resulted in the development of equipment items not common to the ordinary road job. The special 30-ft. blade for preliminary and final shaping was the most important. Improvements can be made on its construction and use but it is classed as an experiment many times worth the effort.

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SAFE WAYS IN WAR PRODUCTION

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Soil-Cement Inspection

Soil-cement inspection was provided 24 hours per day in three 8-hour shifts. The inspection covered grading, subgrade conditions, form setting, preparation of material for processing, all details of processing operations, and protective covering. Labmen ran the moisture control tests, moisture-density tests, depth checks and actual density tests.

Acknowledgments

Construction inspection on the Navy Base was handled by civilian engineers. B. E. Merrifield was chief navy inspector assisted by F. E. Butcher. Stephen Poe, borrowed from the Reclamation Service at Denver, Colorado, was in charge of landing mat inspection and field laboratory. Ralph H. Richardson, S. Reynolds, and C. F. Stewart were soil-cement construction inspectors. James Oyler, Wayne Proctor, John Devine, Henry Harris and Richard Randall were labmen.

The prime construction contractors for the Base were J. L. Simmons Company, Inc., and United Construction Company (joint venture). Contractor's representatives were Morris E. DeWitt, project director; B. B. Jackson, project manager; and W. R. Stoune, general construction superintendent. The soil-cement landing mat was constructed as part of the prime contract with supervision for the contractor as follows: B. J. Hiller, landing mat superintendent, J. I. McDon-

EQUIPMENT USED ON SOIL-CEMENT CONSTRUCTION

- 1—22-36 McCormick-Deering rubber tired tractor
- 3—I-6 International rubber tired tractor
- 1—I-9 International rubber tired tractor
- 1—T-40 International tractor
- 1—TD-18 International tractor
- 1—Diesel 50 Caterpillar tractor
- 4—6' Seaman Motorized Pulvi-mixer
- 4—9' Killefer Material Mixer (heavy duty cultivator)
- 2—4 Bottom 18" John Deere gang plow
- 2—Single bottom 14" walking plow
- 4—Rosco trailer spray units
- 6—1000 gal. water supply tank trucks
- 2—Tandem double drum sheeps foot roller (2"x3" foot pad)
- 2—10' spike tooth harrow
- 2—Bros. wobble wheel pneumatic tired roller
- 1—10 ton Gallion tandem steel roller
- 1—5 ton tandem steel roller
- 2—No. 12 Caterpillar Diesel Auto Patrol
- 1—16'x18' Windrow Box
- 2—4'x8' steel bristle broom drag
- 2—4'x8' nail drag
- 1—26' timber strike-off
- 1—30' built-up blade on 15-30 motor grader
- 1—3,000 gal. water storage tank
- 20 to 50—5 yard gravel trucks
- 3 to 10—Cement trucks (flat beds and dump bodies)
- 2—Form subgrading machine
- 27,500 l.f.—6"x6" timber forms
- 80,000 sq. yd. Sisalkraft paper
- 10—5kw. Gasoline and Diesel light plants

ald, B. G. McClelland and J. C. Broecker, soil-cement construction foremen; A. M. Shelton, mat grading foreman, and Harold Parker, foreman of material placing and preparation. James Burke Construction Company sub-contracted production and delivery of sand-gravel for processing.

Construction of the Naval Base was handled by the Public Works Department of the Ninth Naval District under the direction of Captain R. D. Spalding, CEC-USN. Lieut. H. H. Holmberg, CEC-USNR was Resident Engineer in charge. Ensign J. S.

O'Laughlin, CEC, USNR, and W. E. Johnson, civilian engineer, were assistants to Lieut. Holmberg. Ensign C. R. Krabbenhoft, D-V(s) USNR, was the district representative on soil-cement landing mat construction. Russell B. Moore & Company, architect-engineers, managed the design, layout and engineering.

The Ninth Naval District was the recipient in November of the 1942 "Year Award for Outstanding Construction in the Navy," an achievement award made annually by the Bureau of Yards and Docks.

Highway Traffic Decline 41%

Rural traffic in 16 mileage rationed States dropped 41 per cent in November from the volume of November, 1941, whereas the decrease in 25 unrationed States was only about half as much, the Public Roads Administration of the Federal Works Agency reported Jan. 11 in releasing monthly traffic data from State highway departments.

Five hundred "electric eye" traffic counters in 41 States were utilized in

cent, against 25 per cent in the unrationed States. The September declines were 43 per cent and 23 per cent, respectively.

Twenty-eight per cent fewer passenger cars but nearly 2 per cent more trucks and busses paid tolls during November at 21 toll facilities in the rationed zone from Maine to Florida.

The indicated decline in passenger cars at 42 drawbridges in eastern

Fleetwood Viaduct in Westchester County adjacent to New York City. The volume of trucks and busses at the two tunnels declined less-than-1 per cent and 10 percent, respectively.

In the unrationed area, on the other hand, less than 2 per cent fewer passenger cars compares with 6 per cent fewer trucks and busses on 65 toll facilities.

November tax collections on motor fuel were also announced by Public Roads Administration. Representing usage largely during the previous month of October, these collections were down from the same period of

SAFE WAYS IN WAR PRODUCTION



NEW WORKER—Every new employee in a Bethlehem Plant wears this button. It helps to fix his attention on safety. It signals to more experienced employees that he is new to the plant, and they keep an eye on him, and do not hesitate to offer friendly guidance in case he forgets instructions and unknowingly breaks any safety regulation.

Industrial accidents, bad enough because of the human distress they cause, are also a grievous drag on production. Every day that injury lays up a worker means lowered output of the materials our armed forces are asking for.

Safety engineers know they must be more than ever on guard as pressure for production intensifies and men work against time. When war came, Bethlehem Steel Company expanded its accident-prevention program to meet the new conditions. Special efforts were addressed to the new employee to make him safety-conscious from the moment he walked into the plant. And by posters, group meetings and individual instruction, the safe way of doing his job was ground into the subconscious of new Bethlehem employee and veteran alike.

Significant are the results of a current study, showing that of all disabling accidents to Bethlehem employees less than one-third occur in the course of their work. Even with employment rolls upped by the tens of thousands and plant operations at top speed to meet the demands of the war program, the Bethlehem employee is safest, best protected against injury, during the hours he spends on the job.



AUTOMATIC HAND GUARD—This man is operating a trimming press. If he should absent-mindedly let his hands move too near the danger zone, the two cables will automatically whisk them back to safety, before the ram of the press descends.



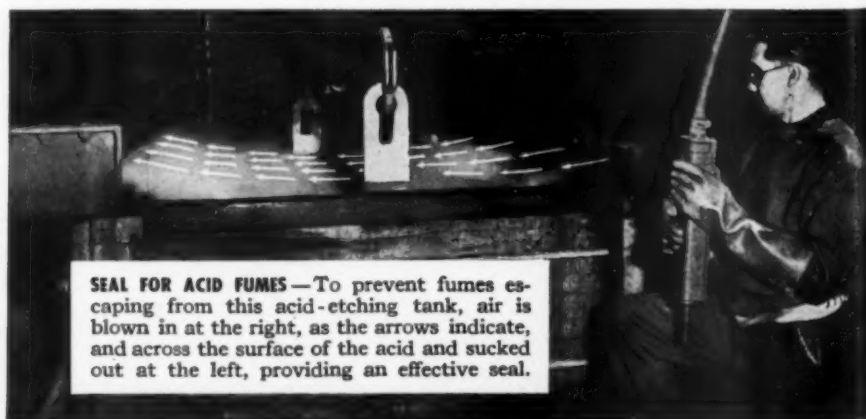
100% HEAT-INSULATED—Asbestos-covered hood, chrome-leather full-length apron, chrome-leather gloves, chrome-leather full-length sleeves and asbestos guard on torch handle give this worker complete protection against heat and flying sparks.



EYES DOUBLY GUARDED—Even though this grinder is equipped with a heavy glass shield, the eyes of the man who is operating it are given further protection against sparks or flying bits of abrasive by the cup goggles that he is wearing.



Bethlehem Steel Company is actively supporting the National Safety Council in its campaign against accidents in war production, through the War Production Fund to Conserve Manpower.



SEAL FOR ACID FUMES—To prevent fumes escaping from this acid-etching tank, air is blown in at the right, as the arrows indicate, and across the surface of the acid and sucked out at the left, providing an effective seal.

ROADS AND STREETS

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Edge plow (single-bottom walking plow) cleaning mixture away from adjacent soil-cement. Depth guard is visible. Man standing on cleaning blade

flector lamps mounted to illuminate the blading action.

Soil-Cement Inspection

Soil-cement inspection was provided 24 hours per day in three 8-hour shifts. The inspection covered grading, subgrade conditions, form setting, preparation of material for processing, all details of processing operations, and protective covering. Labmen ran the moisture control tests, moisture-density tests, depth checks and actual density tests.

Acknowledgments

Construction inspection on the Navy Base was handled by civilian engineers. B. E. Merrifield was chief navy inspector assisted by F. E. Butcher. Stephen Poe, borrowed from the Reclamation Service at Denver, Colorado, was in charge of landing mat inspection and field laboratory. Ralph H. Richardson, S. Reynolds, and C. F. Stewart were soil-cement construction inspectors. James Oyler, Wayne Proctor, John Devine, Henry Harris and Richard Randall were labmen.

The prime construction contractors for the Base were J. L. Simmons Company, Inc., and United Construction Company (joint venture). Contractor's representatives were Morris E. DeWitt, project director; B. B. Jackson, project manager; and W. R. Stoune, general construction superintendent. The soil-cement landing mat was constructed as part of the prime contract with supervision for the contractor as follows: B. J. Hiller, landing mat superintendent, J. I. McDon-

EQUIPMENT USED ON SOIL-CEMENT CONSTRUCTION

- 1—22-36 McCormick-Deering rubber tired tractor
- 3—I-6 International rubber tired tractor
- 1—I-9 International rubber tired tractor
- 1—T-40 International tractor
- 1—TD-18 International tractor
- 1—Diesel 50 Caterpillar tractor
- 4—6' Seaman Motorized Pulvi-mixer
- 4—9' Killefer Material Mixer (heavy duty cultivator)
- 2—4 Bottom 18" John Deere gang plow
- 2—Single bottom 14" walking plow
- 4—Rosco trailer spray units
- 6—1000 gal. water supply tank trucks
- 2—Tandem double drum sheeps foot roller (2"x3" foot pad)
- 2—10' spike tooth harrow
- 2—Bros. wobble wheel pneumatic tired roller
- 1—10 ton Gallion tandem steel roller
- 1—5 ton tandem steel roller
- 2—No. 12 Caterpillar Diesel Auto Patrol
- 1—16'x18' Windrow Box
- 2—4'x8' steel bristle broom drag
- 2—4'x8' nail drag
- 1—26' timber strike-off
- 1—30' built-up blade on 15-30 motor grader
- 1—3,000 gal. water storage tank
- 20 to 50—5 yard gravel trucks
- 3 to 10—Cement trucks (flat beds and dump bodies)
- 2—Form subgrading machine
- 27,500 l.f.—6"x6" timber forms
- 80,000 sq. yd. Sisalkraft paper
- 10—5kw. Gasoline and Diesel light plants

aid, B. G. McClelland and J. C. Broecker, soil-cement construction foremen; A. M. Shelton, mat grading foreman, and Harold Parker, foreman of material placing and preparation. James Burke Construction Company sub-contracted production and delivery of sand-gravel for processing.

Construction of the Naval Base was handled by the Public Works Department of the Ninth Naval District under the direction of Captain R. D. Spalding, CEC-USN. Lieut. H. H. Holmberg, CEC-USNR was Resident Engineer in charge. Ensign J. S.

O'Laughlin, CEC, USNR, and W. E. Johnson, civilian engineer, were assistants to Lieut. Holmberg. Ensign C. R. Krabbenhoft, D-V(s) USNR, was the district representative on soil-cement landing mat construction. Russell B. Moore & Company, architect-engineers, managed the design, layout and engineering.

The Ninth Naval District was the recipient in November of the 1942 "Year Award for Outstanding Construction in the Navy," an achievement award made annually by the Bureau of Yards and Docks.

Highway Traffic Decline 41%

Rural traffic in 16 mileage rationed States dropped 41 per cent in November from the volume of November, 1941, whereas the decrease in 25 unrationed States was only about half as much, the Public Roads Administration of the Federal Works Agency reported Jan. 11 in releasing monthly traffic data from State highway departments.

Five hundred "electric eye" traffic counters in 41 States were utilized in making the count.

The November drop of 41 per cent in 16 rationed States from November, 1941, compared with a corresponding decrease of 21 per cent in 25 unrationed States. The October decline in the rationed States was 40 per

cent, against 25 per cent in the unrationed States. The September declines were 43 per cent and 23 per cent, respectively.

Twenty-eight per cent fewer passenger cars but nearly 2 per cent more trucks and busses paid tolls during November at 21 toll facilities in the rationed zone from Maine to Florida.

The indicated decline in passenger cars at 42 drawbridges in eastern North Carolina was 36 per cent, compared with 1 per cent for trucks and busses. The volume of passenger cars was down 36 per cent at Queen's Midtown Tunnel in the New York City area; 19 per cent at Sumner Tunnel, Boston; and 50 per cent on

Fleetwood Viaduct in Westchester County adjacent to New York City. The volume of trucks and busses at the two tunnels declined less-than-1 per cent and 10 percent, respectively.

In the unrationed area, on the other hand, less than 2 per cent fewer passenger cars compares with 6 per cent fewer trucks and busses on 65 toll facilities.

November tax collections on motor fuel were also announced by Public Roads Administration. Representing usage largely during the previous month of October, these collections were down from the same period of 1941 about 25 per cent in the rationed area and 14 per cent in the unrationed area, according to returns from 28 States. Net receipts in these States totaled \$38,983,000 or 19 per cent less than in the previous November.

ALCAN HIGHWAY

By HAROLD J. McKEEVER
Associate Editor, Roads and Streets

8—Culverts And Bridges

Scores of racing streams were bridged first by pontons then by temporary log trestles, many of which are to be replaced in 1943

WITH the exception of a small amount of creosoted stave pipe and nested corrugated iron pipe, the thousands of culverts under this long road are of rough lumber or logs hastily hacked from roadside timber. For most structures no plan sheets were used, but just rule-of-thumb designs known to be strong enough, with each field commander developing his own variations in framing. Some regiments had bridge companies specializing in this work.

Pioneer Culverts

This is not a region of heavy rains and except in the spring, there is little "normal" surface drainage. In the absence of run-off data, drainage area, etc., one or two standard culvert sizes usually were made to do. One location would be given a "one log" culvert, another a two or three log. One commanding officer interviewed by the writer adopted a minimum waterway of 3 ft. high by 4 ft. wide, which would suffice for most sites and enable the crew to get its cutting work down to a quick routine. Another found that a two-log-high opening was the least size practical, and adopted a 24x24-in. minimum. Culvert and bridge work was planned and later inspected by the regiment plan section.

The most common procedure was for the crew to work well up with or in front of the pioneer bulldozer, cutting logs. The first step after trenching across the road path was to throw down a mat of 12-in. or smaller poles parallel with the line

The following 13 pages conclude Mr. McKeever's series of articles on Alcan Highway. The first sections, published in January, covered the construction strategy; specifications; clearing, grading and follow-up improvements; maintenance and winter problems; the builders of Alcan; historical notes; and equipment repair methods.

of the road, as shown in Figure 7. Then, if only a small seepage was to be taken care of, a "one logger" was

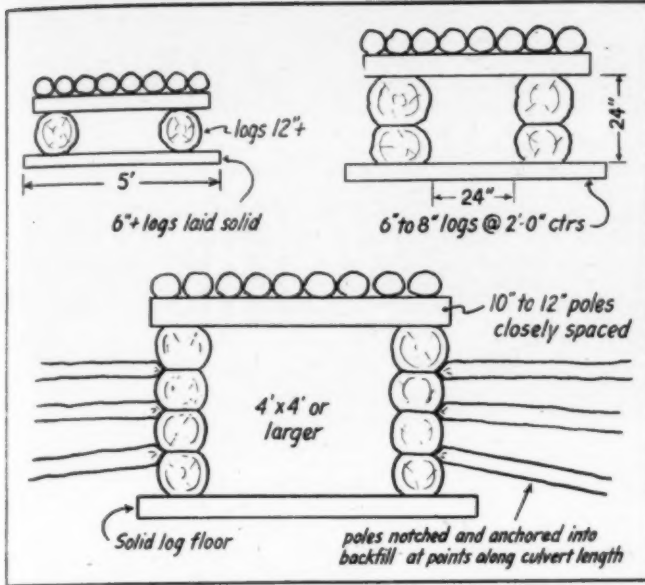
built by laying two transverse poles and then roofing with two layers of small 6-in. (\pm) poles, and backfilling.

Sometimes culverts were framed in the woods and towed to the road, while dozers made a trench ready. Larger culverts were strengthened with back braces anchored in the backfill, or with vertical posts.

Culvert locations and depths below the surrounding ground were often governed by the possibility of ice. But

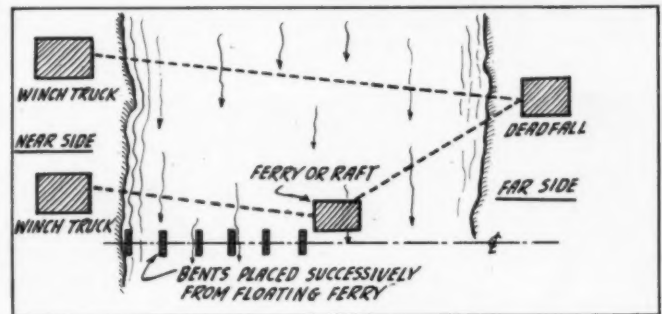
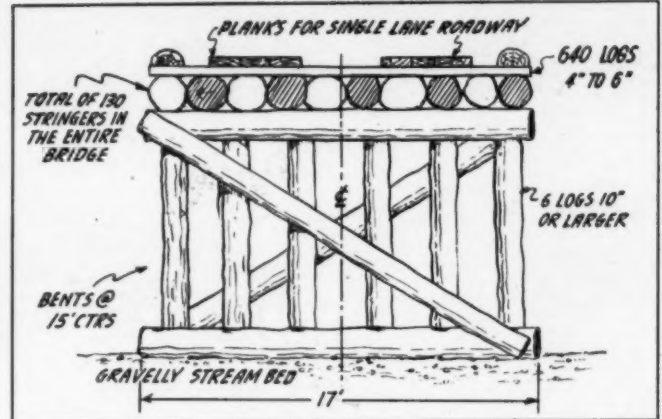
Three structures per day was not an unusual accomplishment for a culvert crew





(Fig. 7) Typical log culverts as built by Army forces

(Fig. 9) Field sketch showing details of 200-ft. pile trestle built in three days and nights by one small Army unit, without heavy equipment and without a man getting in the icy water



where ice was expected to "glacier" out from a gully from slow-freezing springs, and build up on the road (see Jan., 1943, *ROADS AND STREETS*, p. 48), the proper elevation and size of the opening were difficult to gauge. The main object was to provide a good outlet to hasten drainage when thaw starts.

Temporary Bridges

Approximately two hundred timber bridges were completed by the end of November, including several trestles ranging from 200 to 2300 ft. The bridge problem loomed serious in March and April when pontoons were used to get supplies across, and it continued to be a major problem right up to the end of the year, when ice had taken out short sections of trestle on several larger rivers.

A few corrugated iron culverts have been placed under the more highly developed sections of Alcan Highway. This shows a Lorain shovel trenching for installation of 24-in. Armco pipe



Most of the earlier bridges were of logs, but as saw mills were set up an increasing amount of dimensioned timber facilitated work in the field. Small creek bridges of a few spans were handled in routine, usually by setting framed bents on the gravel, bracing them, throwing down 12-in. log stringers, putting on a layer of smaller cross logs for floor, and finally adding the luxury touch of two wheel tracks of flat planking and a split-log edge rail. Railing was built up during November as snowfall approached.

Where the current was swift or ice and drift considered likely to demand stronger pier construction, simple earth or gravel-filled log cribs were used instead of bents. Fourteen to 16 ft. seemed to be typical spans, and bridges with five stringer logs theor-

etically good for H-15, have carried as high as 44 ton loads.

Often construction of bridges over fairly large streams was required with utmost speed to relieve ponton equipment or eliminate a slow ferry and the army companies were pitted against each other to set new speed records. At one camp the commanding officer related with pride how a 200-ft. log trestle was completed in three October days and nights, from standing trees to traffic. This structure was of typical 15-ft. framed bent construction, with bents fabricated on the bank and set in position. Just an ordinary bridge, but each log was trimmed by hand and toted 400 feet by manpower. At night the men worked out over the icy stream with no lights except from a truck on the bank. Since pontoons, cranes or other equipment were not available, each bent had to be towed into position. Fig. 9 shows the rig-up of winch trucks and a deadman, coupled with a log raft, successfully used to ferry the bents into place. Not a man got wet, and the only casualty was a hammered thumb.

Civilians Show Speed, Too

Another and larger example of speed was in the erection of a 57-span pile trestle with a long approach crib across the swift Peace River near the southern end of the road. This river, one of the largest in flow, is normally 17 ft. deep at the site, with a 25-ft. flood height. The current is 7 to 12 mph.



Permanent type timber trestle being constructed by combined Army and civilian forces over the mouth of a lake. Vehicles in foreground are waiting to be ferried



Ponton trestle under construction over large stream in southern section. Winch trucks helped drag stringer logs into place for hasty temporary bridges

At left — Driving of piles through ice at Nisutlin Bay. Lower left view shows splice for 70-ft. pile



Speed was the governing factor in bridge design and construction

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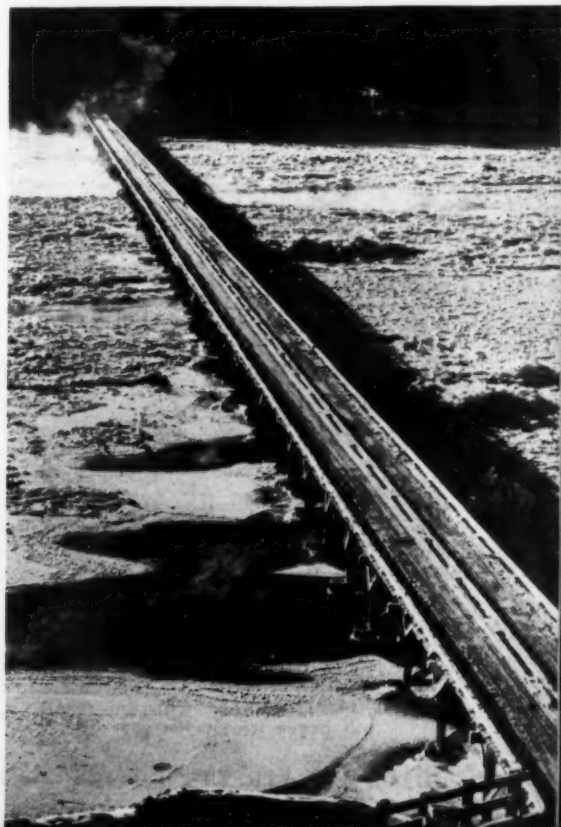


Sturdy preformed winch rope dragging stringer logs into place. Tractor and truck winches were indispensable on Alcan roads

Late in November, ice hampered placement of the last remaining bridges. Light ponton trestle sections, set through the ice as shown, were used to get traffic across until piling could be driven for an all-timber trestle to serve until spring

Stone-filled crib piers were used to span this shallow mountain stream. The deck was anchored down with segments of discarded wire rope. Note pile clusters for protecting temporary bridge from drift and ice

Built in 9 days!
One of the longest temporary trestles on the Alaskan Highway. Note center straddle curbs to hold vehicles on the single-lane deck. Several trestles, damaged by early ice in November, were quickly repaired. Many trestles are expected to go out in the spring



With this as a setting, the Okes Construction Company cut pile logs, transported them 55 miles, drove piling with one hammer and a 1¼ yd. crane (a second crane helping toward the end), and had traffic on the bridge in 22 days and nights. Again, just another bridge, but a remarkable showing with limited equipment.

Note: This bridge, which along with nearly all larger temporary bridges is expected to go out with the ice next spring, was damaged by ice late in November while the river was freezing up but quickly repaired. Work is now under way on a permanent bridge across Peace River, which is to have a 900-ft. suspension span between main towers and a total length of 2,000 ft. (figures approximate). Construction of cofferdams began late in the year. Timber for pier piles, falsework and cofferdams is being cut upstream and hauled to the site. Dufferin Paving Company has the contract for the substructure. John A. Roebling Sons Company is constructing the superstructure. If steel is provided on the schedule anticipated this structure should be completed in May.

Liard River Bridge

One of the Army's major temporary bridges is that at the Liard River, which is crossed in a small canyon presenting difficulties in approach as well as bridge. One of the largest rivers in western Canada, it is from 700 to 1400 ft. wide and flows normally 60,000 cfs. with a 6-mph. current. More engineering study was given to this site than for most crossings to date, borings disclosing layers

of gravel alternating with fine black sand which made pile driving hard. Engineering data included a profile of the stream bed, and an analysis of the path of the stream, character of bank, accessibility and other factors that would help select a site suitable for both a temporary and a subsequent permanent bridge.

The temporary bridge consists of 1185 ft. of trestle involving driving of 350 piles by Army forces. Still again it was the old story of surprising speed in the face of difficulties. Fall rains, freezing weather, swift current, a 4-ft. rise, big boulders in the path of the piling, a 10-hour loss due to breakdown of equipment. Yet the bridge was ready in 9 days.

Men worked the clock around in three shifts, with crews pitted against each other to make a showing. Stringers were floated down to the site on pontoons, and so keen was the spirit of accomplishment that rival crews even helped each other cut timber when lumber ran out during work.

On Sept. 22, when traffic started to roll, a quarter-mile long line of ration and supply trucks went across, indicating the urgency of the job. And again, not a man was scratched.

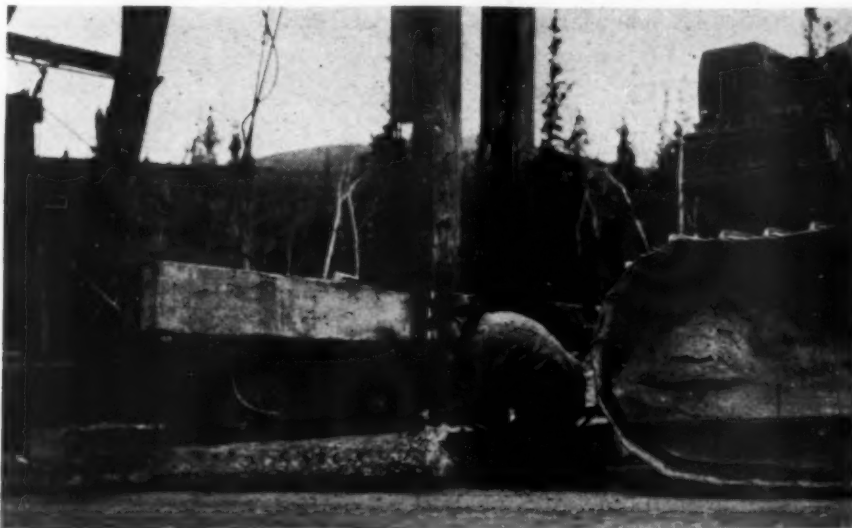
Many Other Examples of Resourcefulness

From Alaska south, numerous other examples of fast and ingenious erection of temporary bridges could be



This PRA driver outfit was skidded many miles to a rush bridge job on Army's northern sector (see text)

Adjusting the cable between the tractors and the driver rig shown above.
Note the log skids



Ferrying army supply truck across Nisutlin Bay, in Yukon, where a permanent trestle was begun late in the year

cited. One interesting detail noted was the case, near Whitehorse, where a pile driver had to be moved to a site 27 miles distant, but no machinery trailer was available. The solution was to skid a completely erected 4000-lb. pile driver with donkey engine the whole distance, putting false skids under it and building skids ahead. Some pretty steep grades were negotiated, too. The order to build the bridge—this was Dowell's job, by the way—came on a Sunday. By Thursday the driver had turtled to the site, and in 9 more days a 400 ft., 19-span timber trestle was carrying traffic.

Piling for this job, incidentally, was towed down stream 19 miles with a small boat with an outboard motor.

White River Difficulties

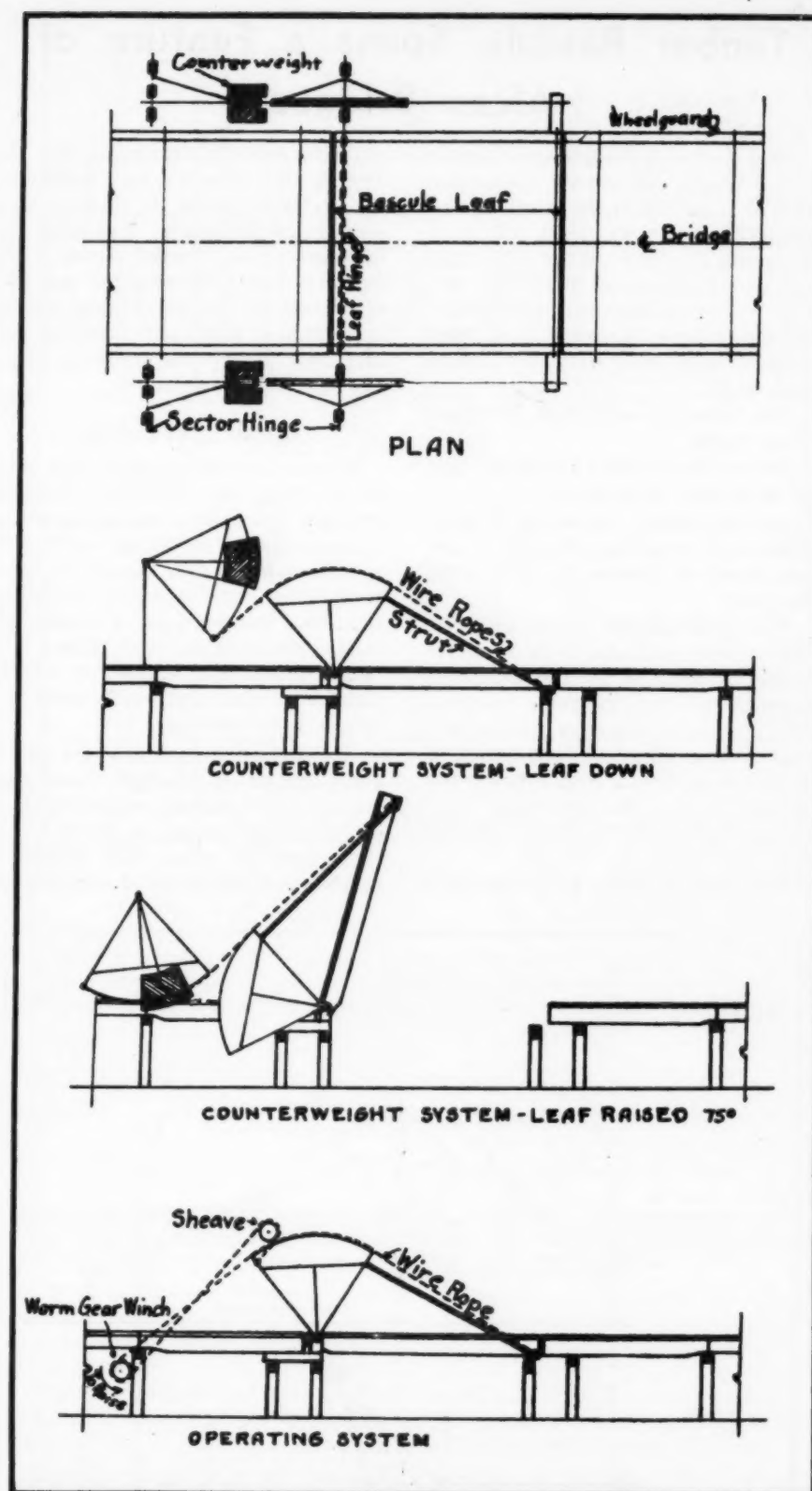
Early winter brought new problems on the few temporary bridges which remained unbuilt. Among the last links was the structure at the White River in Yukon. The crossing site is a river flat some $2\frac{1}{2}$ miles wide, where flow ordinarily occupies only about one-tenth of the channel. Due to progressive top-and-bottom freezing of the stream, however, the shallow flow had spread to the full flood width by late November. What had been planned as three short trestles across a nearly-dry channel became a problem of bridging two miles of ice.

The problem was solved for the winter by setting trestle through the ice. Ponton trestle sections with steel posts resting on gravel were included. In setting timber piles and posts, experiments were conducted in the best method of penetrating the frozen gravel. These attempts, while waiting for compressors, included chiseling down with hand tools, burning holes with diesel fuel, jetting with cold water, and dynamiting.

By the time jackhammers arrived, winter cold had become so severe that air tools had to be warmed every few minutes over burning oil drums.

Permanent Bridges Planned

All major structures requiring special plans are being designed by the Public Roads Administration and built under its supervision. Permanent bridges now under construction or definitely planned for the present road include three steel-and-concrete structures, and several timber trestles across the arms of lakes. The earliest of these scheduled to be completed will be the two over the still waters of Nisutlin River and Teslin Bay, south of Whitehorse. These structures



(Fig. 10) Diagram showing bascule operating system

are pile trestles with movable timber spans of unique design and construction.

Situation surveys for permanent bridges have been made by PRA and thorough engineering procedure was followed in determining the nature of

subsoil, stream flow, etc. Contrary to common impression, the maximum flow in most of the rivers is not in the spring, but usually in late summer. Its cause is an early-fall snow on the mountains followed by a warm rain and quick thaw.

Timber Bascule Spans a Feature of Alcan Bridges

How to provide for passage of small lake fishing craft and river steamers so vital to the life in the southwestern Yukon Territory has been solved by designing four pile trestles with timber bascule spans of interesting design. Two permanent type structures now under construction as part of the present Army route are to have such spans.

The following conditions governed their design:

Critical materials had to be kept to an absolute minimum;

And the leaves were to be of accident-proof operation, capable of being raised or lowered by boat crews by hand.

Two span lengths are involved—25 ft. for lake craft and 45 ft. for river boats, as required by the Canadian government for navigable streams. The bridges are standard pile trestles, one typical structure consisting of 2400 feet of trestle with 6-pile bents at 25-ft. ctrs., this one using pony bents incidentally to avoid splicing piles.

The general design of the movable

spans is shown in Figures 10 and 11. The shorter structure uses longitudinal stringers similar to those in adjoining trestle panels; the larger is designed as a through truss with stringer floor. The entire bascule spans without counter-weights weigh an estimated 40,000 and 75,000 lb. respectively. All bascule spans are two-lane, 24 ft. between curbs.

Bascule Leaf Details

The counterweight system is so balanced that one man of average strength can operate the bridge with a hand winch. This lifting winch has a positive worm gear instead of spur teeth, which together with a wire rope hold-back assures positive control of raising and lowering at all stages. The partly lifted span cannot be blown upward by wind, and wind cannot interfere with lowering.

As noted on the sketches the operating system is separate from the counterweight system, except that the counterweight sector is utilized for the operating rope. The counterweight, the only piece of concrete in

the structure, moves in an arc corresponding to the movement of the center of gravity of the bascule leaf.

As is usual with bascule bridges the leaf is not entirely counterweighted, and the leverage necessary for overcoming the slight un-balance is provided by the operating rope system. This system is connected to the top of the bascule leaf and passes around the leaf sector, thence to the worm gear hoist drum. The operating rope is wrapped around the hoist drum a number of turns and then led off over an idler sheave. Thence it passes down to the lower edge of the sector, as shown in the figure.

The counterweight system winds on one sector as it leaves the other. Sectors are of 12-ft. radius on the shorter and 22-ft. on the longer spans. The rope path of all sectors is reinforced with metal, and designed to allow the necessary number of ropes to operate without contact one with another. A considerable range of rope sizes can be used, thus permitting use of such rope as is obtainable in this area.

The structural members of the short bascule are to be fabricated in a woodworking shop at Whitehorse and transported to the site for erection. The members of longer through trusses will doubtless be fabricated in the States.

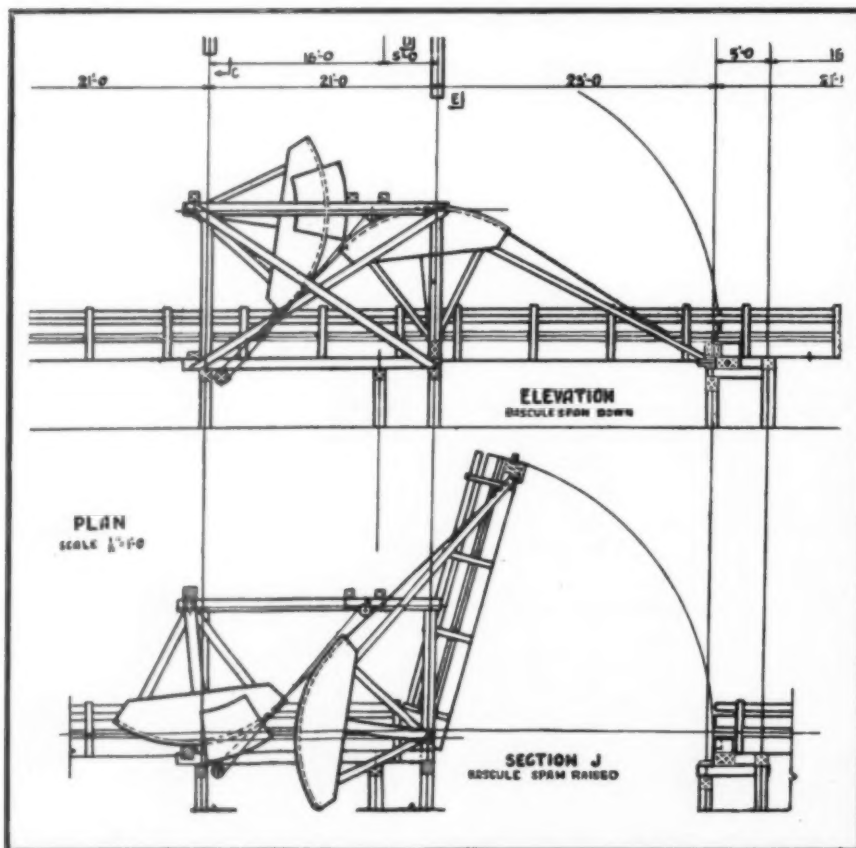
The only metal materials involved are the winches, sheaves, sector hinges, wire rope, bolts and timber connectors and metal for the rope path. Hinges and small metal shapes used in the sectors are shop-made from discarded piping and scrap metal.

Plan of Construction

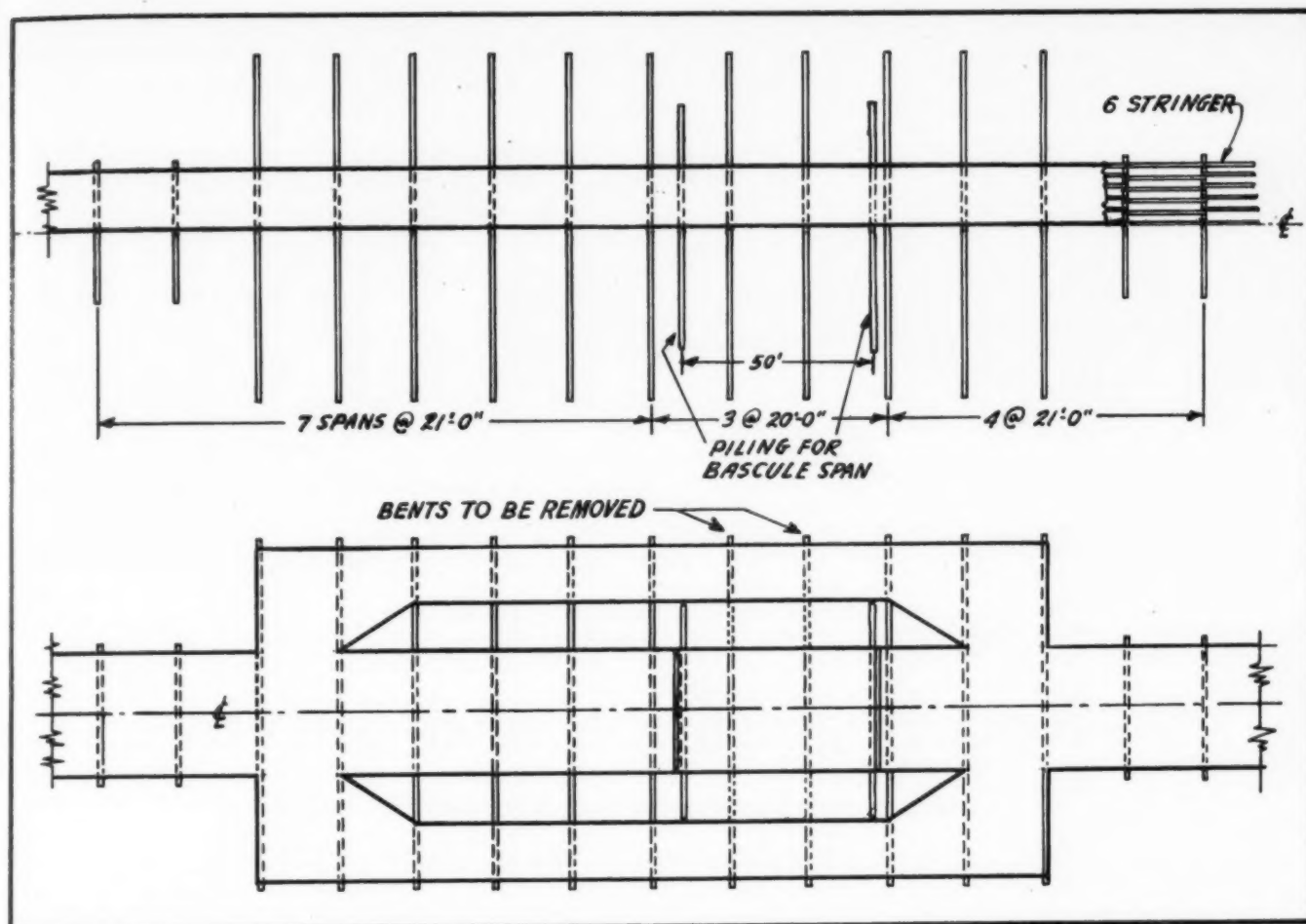
The bridges are all being built with single-lane deck, however with all piles driven for two-lane development and for falsework in connection with placing bascule spans and detouring traffic around them at the time. Standard trestle panels continue across the bascule area, necessitating closing the channel to navigation for a brief time during erection. The pile driver is not needed in setting the leaves, but is freed for urgent work elsewhere.

The sequence of construction as shown in Fig. 12 is as follows:

1. Drive all piling in one operation, as aforementioned.
2. Build single-lane deck.
3. Widen deck to two lanes. The bascules may be built either before or after the widening operation.
4. Build detour deck-extension around the site of the bascule span, install the bascule, and remove detour



(Fig. 11) More detailed views of 25-ft. timber bascule span. The 50-ft. span is of similar design except that through truss is used instead of trestle type longitudinal stringers



(Fig. 12) UPPER VIEW: All piling in place; initial single-lane deck completed. LOWER VIEW: Deck widened to two lane and detour built around bascule span during its installation. (Pile bents and detour decks to be removed from navigation channel, leaving remainder of detour roadways as turnouts.)

spans from the navigation channel. The remainder of the detour structure will be left in place to provide added passing or turn-out space highly desirable on a long bridge.

All bridges involving this interesting feature are designed to H-15 loading. These and other permanent-type timber and concrete-and-steel bridges in the northern sector of Alcan Highway are being designed in the PRA's Whitehorse office.

Flight Strips Save Bombers in Two Emergency Landings

Flight strips which the Public Roads Administration is building in cooperation with the Army Air Forces and the state highway departments have already been in action on the home front, according to PRA Commissioner Thomas H. MacDonald in a radio-network talk.

The first flight strip, which was located on the Southeast coast, was completed only last June. Subsequently it saved an Army bomber. The bomber was hemmed in by storms and received reports that low ceilings closed every airport within safe flying distance.

"Having reports on the recent completion of a flight strip 30 miles away," said MacDonald, "the pilot set his course in that direction, found the field open and made a safe landing, saving ship and crew."

Commissioner MacDonald told of a similar incident on the Pacific Coast, where 10 or 15 such emergency landings have already been made. "Loss of either of the planes in the two instances," he said, "would have cost the government almost as much as the flight strip cost, to say nothing of the priceless loss of trained men."

Defining a flight strip as a "bargain counter airport," with only one runway, but that one "like the runways on first-class airports," Commissioner MacDonald revealed that more than a score of flight strips have been completed or are under construction, and that others are in the planning stage. He predicted that many of the flight strips now being built to meet the needs of war will be of continuing usefulness to civil flyers, both commercial and private, after the war.

Seattle Engineer Officer Now Lieutenant Colonel

Major James D. Lang, corps of engineers, has been promoted to the rank of lieutenant colonel, according to announcement recently from the office of Col. Richard Park, Seattle district engineer.

Lt. Col. Lang serves the Seattle engineer district as executive officer for construction matters pertaining to Alaska. He was assigned to this district as a first lieutenant in September, 1938, coming from the engineer school at Fort Belvoir, Virginia.

J. W. Robinson New Chairman House Roads Committee

Congressman J. W. Robinson, of Utah, has been named to the chairmanship of the House Roads Committee. He succeeds Representative William Cartwright, not re-elected. Representative Robinson, who has served on the Roads Committee since 1933, is well known to many highway engineers and contractors.



Many miles of the location follows ridges to take advantage of better drainage. Long tangents were a luxury reserved for more leisurely future relocation

U. S. Army photo

9—Reconnaissance and Surveys

Air scouting and streamlined locating method helped
keep surveyors ahead of the bulldozers

As Done by the Army

BECAUSE of the speed required to start without delay and build many miles of pioneer road per day, the usual methods of road location involving careful ground reconnaissance, platting and staking had to be dispensed with on Alcan Highway. Mindful of the need for streamlined location methods the Corps of Engineers issued instructions not to attempt to locate the road in detail but to follow the general route and get only certain brief information.

The points to cover were location of distant control factors, such as major stream crossings, mountain passes, etc., and data on timber, soils, gravel pits and other resources. Flexible, fast-moving parties of half a dozen men with pack animals were contemplated. The original plans was to consolidate and plat reconnaissance data every five miles.

In addition to control factors there were several other major considerations. One was the necessity of staying, wherever possible, on the sunny southern or southwestern slopes of valleys, where cleared ground would dry out more quickly and aid grading, and where spring thaw problems were likely to be less severe. Drainage also governed the detailed location. Ridges

were followed extensively, and creek-beds and dry washes avoided along with hillsides likely to be the scene of mud slides, rock falls or glacial flow. Then of course there was the ever-present muskeg.

Aerial observation proved of advantage in establishing the general route, avoiding large lakes and mountains and reducing stream crossings. But it was of little value in determining important topographical and other details because of the dense forest covering. Visual impressions of the country from low flying altitudes were found to be of limited detailed value.

Procedure in Southern Sector

RECONNAISSANCE. At the southern end the method used with best success in arriving at a detailed pioneer location consisted of aerial photography combined with quick ground reconnaissance using photos as a guide. The Army relied chiefly on photos taken at 7,000 to 12,000 ft. These showed patches of muskeg, made visible by contrast in type of covering, and other details and landmarks which could be readily recognized later by ground parties.

Following numerous reconnaissance trips over a given area, during which doubtful paths were eliminated, pon-

ton-equipped planes (for lake landings) made flight photos. These were pieced together into a regional map, and from this map a general location line established between distant points.

The advice of trappers and guides, as well as all available map data, was employed in detailing the route. A typical ground party consisted of 2 Indian guides, 6 to 8 enlisted men under a sergeant, and 2 Engineer officers. Next came field office study. Flight-strip photos overlapping 60% and covering an 18-mile swath were made and studied and intermediate control points a dozen or so miles apart were established. Foot parties went over much of the ground to check muskeg and other features. From their notes and from stereoscopic study of stereo-pairs of overlapping photos (to determine ground slopes) the location was drawn on the photographs.*

LOCATION. Locating parties varied in size, depending on the country, distance from base and need for speed. Much experimenting was done with party organization. One successful

* A detailed account of the interesting survey methods is given in an article by Albert L. Lane, Colonel, Corps of Engineers, entitled "The Alcan Highway—Road Location and Construction Methods" in *The Military Engineer*, October, 1942.

plan was to work two parties in pairs, each party comprising 25 to 35 men including an officer, a dozen men and packers and cook. The first party used several men to clear transit lines and pack trails for camp move-ups. As each new tangent was projected from one visible landmark to another, the tangent's magnetic azimuth was determined by orienting the line with landmarks on the air photo and checking it against the preceding tangent with a protractor. The new bearing was checked against readings of a geologist's staff compass, and sometimes further checked with a lensatic compass. Actual blazing of the line along a tangent involved scouting with careful compass technique and pacing distances by the advance unit, and chaining by the rear unit. Azimuth was checked regularly and the line marked on the air photos was followed by naked-eye stereovision. Altimeter data were used to determine the distance scale of the photos involved, and this scale was checked regularly against ground measurements.

Often due to the need for haste to

keep ahead of fast-pushing dozers, improvised lines were thrown in, and detours around bad ground were blazed without changing tangents or setting new P. I.'s. Sometimes the dozer operator literally "noodled in" stretches through low brush under guidance of a party member standing on the machine and working toward a distant big tree or other objective.

Army Surveys in Northern Sector

The following interesting notes were obtained from the topographic company* which located and surveyed six hundred miles of road from Watson Lake north into Alaska. The big point of difference over methods used for much of the southern sector is that locating was done without the help of air photographs; these were taken later when the road was built, after some weather delay, and proved helpful in surveying and mapping the road as built.

The surveying and platting work consisted of these operations:

1. Air reconnaissance to select the general route.
2. Location by advance party, using

only aeronautical maps, Abney level and ordinary compass.

3. Survey of completed road by rear transit party.

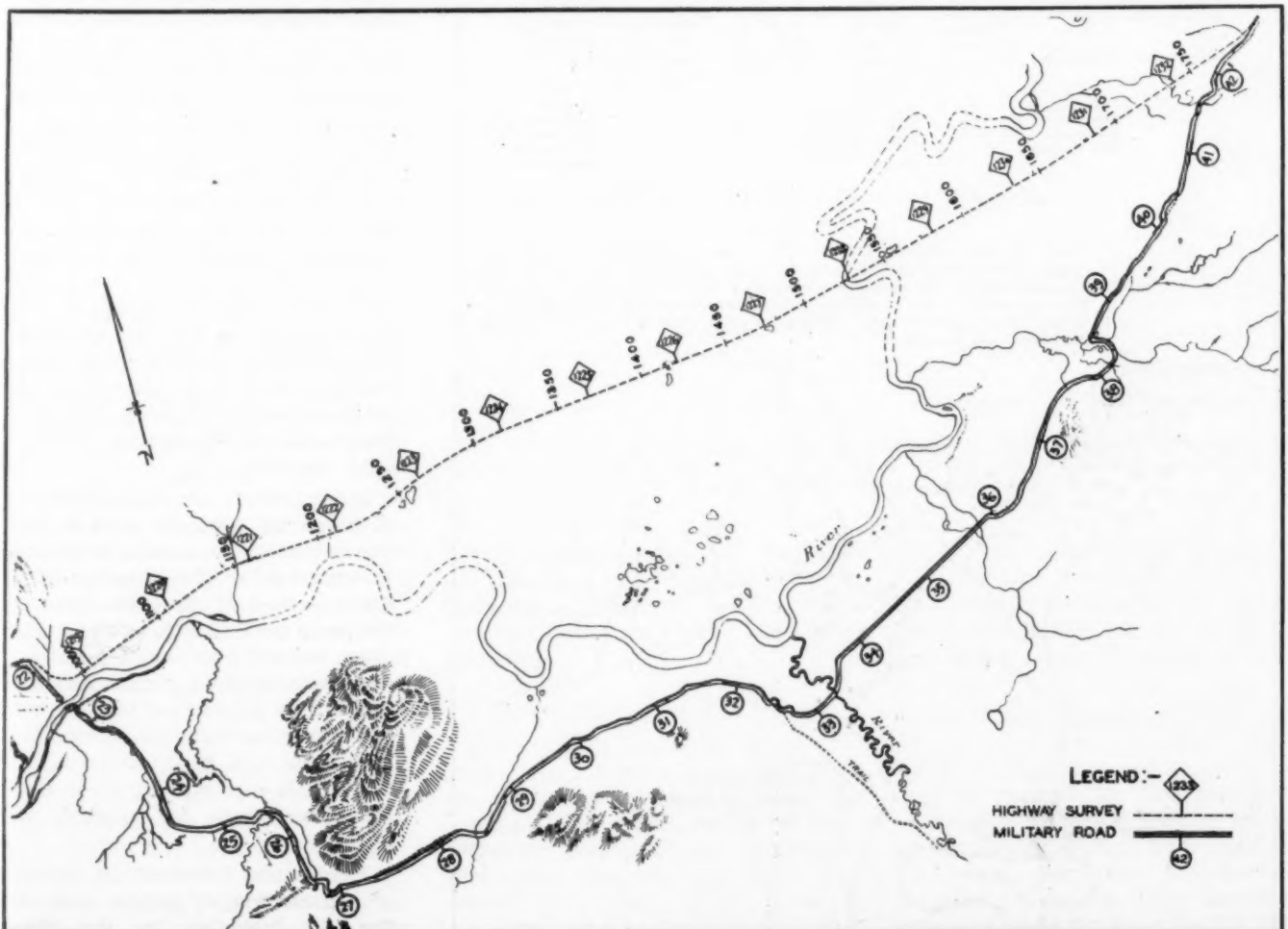
4. Redrawing of field location maps in the office for record and use in future development or relocation.

5. Triangulation to tie in with geodetic survey along the coast.

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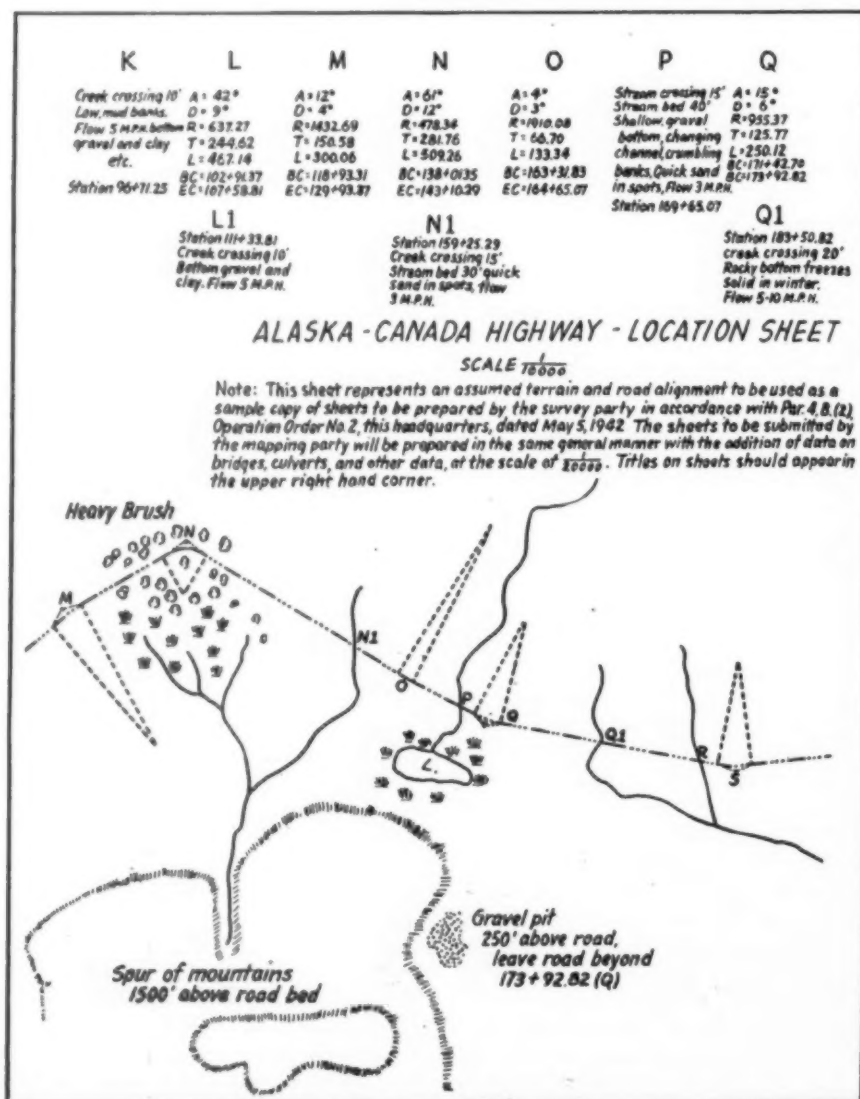
(Fig. 3) Showing an example of the Army's pioneer location and proposed relocation for permanent road (broken line), as plotted by the PRA to scale of 1 in. = 2500 ft. The Army's devious line here resulted from following an old gold-rush trail—an early-season expedient done in anticipation of straightening as time permitted





Portion of a typical flight-strip photo, showing route of Army's pioneer road, drawn on with the help of ground reconnaissance data

(Fig. 2) Portion of theoretical map furnished Army's rear survey parties as a pattern for plotting road in wake of pioneering crew. Note method of tabulating accurate alignment data, required for careful office remapping, future refinements or relocation



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The Editor

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b. *Shooting trees without cutting.* In some cases, it is possible to shoot out the entire tree without cutting, but this is usually advisable only where trees are large and scattered. To shoot the tree out and pull it in the clear with the tractor is an economical method of clearing when properly done. However, conditions must be right to do a good job. On steep slopes the tree can be thrown clear of the right-of-way.

c. *Amount of explosive required.* The amount of explosive necessary will, of course, vary with the types of soil and timber. Some species require more explosive than others. In gravelly or loose soils more explosive is required than in moist compact soil. A slow propulsive explosive is recommended for stump shooting in most soils, although in loose soils a

fast explosive with cutting action is preferable.

More explosives are required in dry soil than in wet. When five or more sticks are used, springing is usually necessary. Large green stumps are more easily shot with distributed charges.

Guard against waste of explosives. Do not shoot the stump so hard that a deep hole is left and most of the roadbed material blown away. A stump should be shot just hard enough to shatter it and enable the trailbuilder to push or pull it out. Stumps up to 6 inches in diameter can usually be pushed out by the trailbuilder without shooting. See tables 803 and 804.

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So many factors enter into stump shooting that any table can be used only as a guide for the first few test shots. The table simply offers a starting point and the explosive foreman must use his own judgment

after a few trial shots. The amounts given are for use in a medium loam soil. Heavier moist soils will take less, and light dry soils will take more explosive. If the stumps are green, more explosive will be needed. If they are partly rotted, less explosive will usually blast them out. See figures 802 and 803.

d. *Placing the charge.* Different classes of stumps have very different roots. Some have heavy tap roots, others lateral spreading roots, while some have both kinds. The loading must suit the nature of the roots and be placed to break their hold in the soil. See figures 802 and 803.

TABLE 804. AMOUNT OF EXPLOSIVE FOR GREEN AND DEAD STUMP BLASTING

Diameter of stump 1 foot above ground Inches	Number of 1¼- by 8-inch cartridges	
	Green stump	Dead stump
Tap-rooted pine stumps—charge loaded in tap root		
6	2	1
12	3	1½
18	5	2
24	7	3
30	11	3½
36	14	5
Hardwood stumps—moist firm soil		
	Green stump	Dead stump
6	2	1
12	4	2
18	5-7	3
24	7-10	4
30	10-13	5
36	13 up	6 up
Old but solid white pine stumps—moist soil		
	Heavy stump	Light stump
18	2-3	3-4
24	3-4	4-6
30	5-6	6-10
36	7-8	10-15
42	10-12	15 up

TABLE 803. AMOUNT AND KIND OF EXPLOSIVE FOR STUMP BLASTING, TRIAL SHOTS

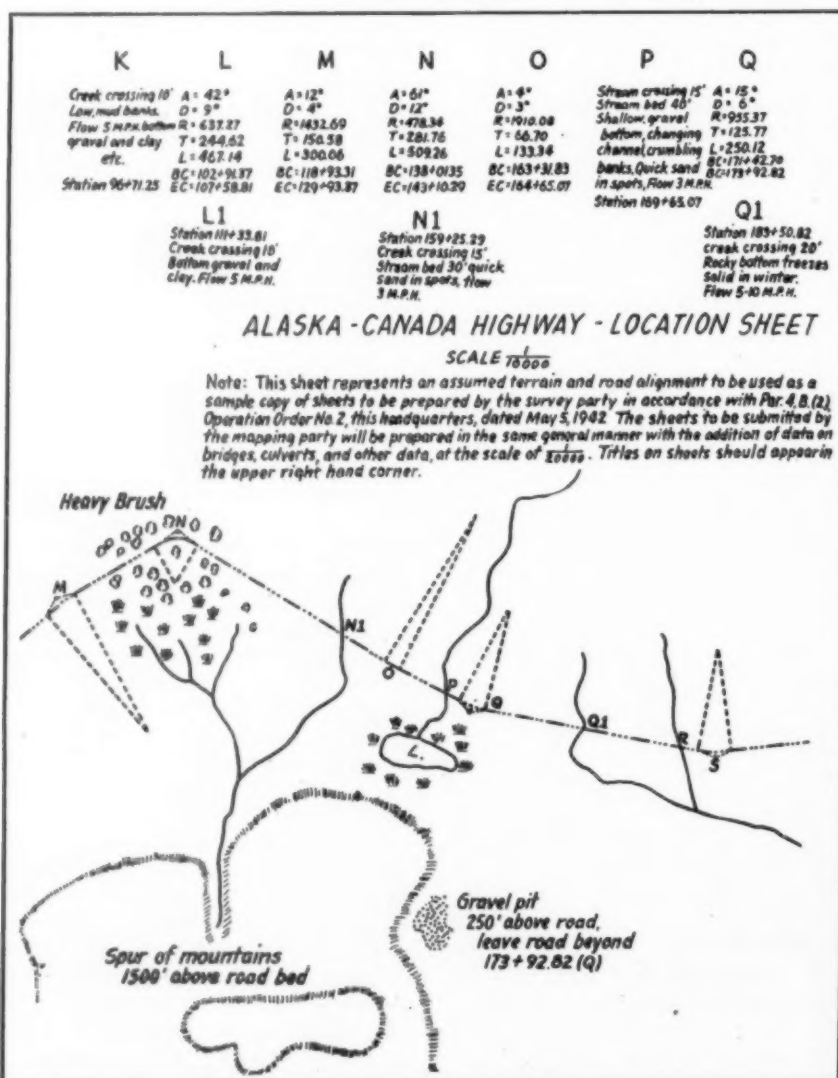
Diameter of stump 1 foot above ground Inches	Number of 1¼ x 8" cartridges or equivalent weight of free-flowing ¹	Type	Kind of explosive (Forest Service Acceptable List)	
			Class	Grade Percent
6	3-4	A	2	20
8	4-5			
10	5-6	B	1a, 1b	20
12	6-8			
14	8-10	A	7	20 or 30 free-flow
16	9-12			
18	10-14	B	2b	20 or 30 free-flow
20	12-16			
24	14-18	A	2, 4, or 7	40 or 60
30	17-21			
36	20-25	B	1a, 1b, or 2b	40 or 60

¹ These trial shots are purposely heavy in order to assure removal. The quantity may be cut if the results of the trial so indicate.



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d. *Placing the charge.* Different classes of stumps have very different roots. Some have heavy tap roots, others lateral spreading roots, while some have both kinds. The loading must suit the nature of the roots and be placed to break their hold in the soil. See figures 802 and 803.

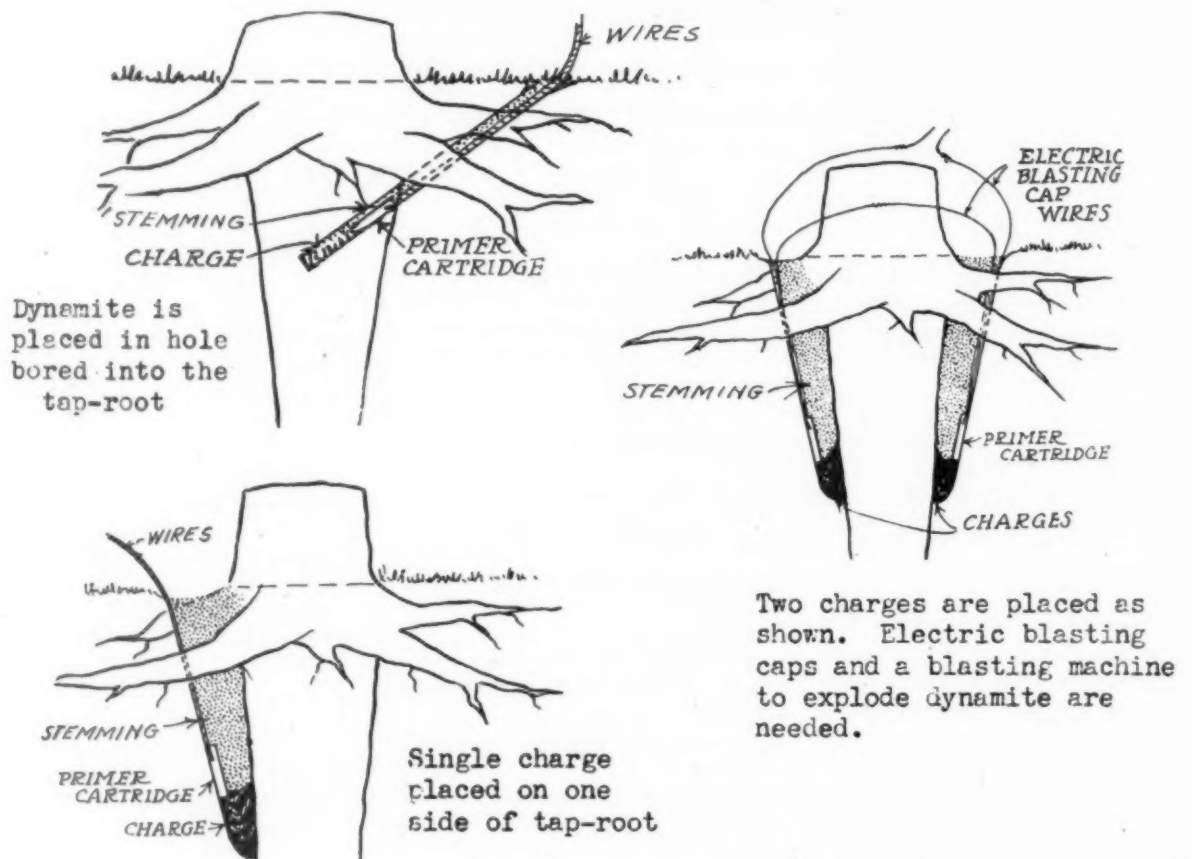
TABLE 804. AMOUNT OF EXPLOSIVE FOR GREEN AND DEAD STUMP BLASTING

Diameter of stump 1 foot above ground Inches	Number of 1¼- by 8-inch cartridges—charge loaded in tap root	
	Green stump	Dead stump
6	2	1
12	3	1½
18	5	2
24	7	3
30	11	3½
36	14	5
Hardwood stumps—moist firm soil		
	Green stump	Dead stump
6	2	1
12	4	2
18	5-7	3
24	7-10	4
30	10-13	5
36	13 up	6 up
Old but solid white pine stumps—moist soil		
	Heavy stump	Light stump
18	2-3	3-4
24	3-4	4-6
30	5-6	6-10
36	7-8	10-15
42	10-12	15 up

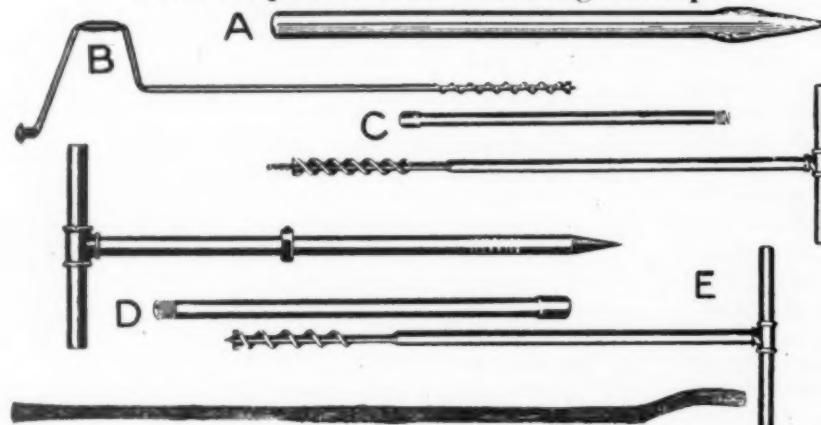
TABLE 803. AMOUNT AND KIND OF EXPLOSIVE FOR STUMP BLASTING, TRIAL SHOTS

Diameter of stump 1 foot above ground Inches	Number of 1¼ x 8" cartridges or equivalent weight of free-flowing ¹	Type	Kind of explosive (Forest Service Acceptable List)	
			Class	Grade Percent
6	3-4	A	2	20
8	4-5			
10	5-6	B	1a, 1b	20
12	6-8			
14	8-10	A	7	20 or 30 free-flow
16	9-12			
18	10-14	B	2b	20 or 30 free-flow
20	12-16			
24	14-18	A	2, 4, or 7	40 or 60
30	17-21			
36	20-25	B	1a, 1b, or 2b	40 or 60

¹ These trial shots are purposely heavy in order to assure removal. The quantity may be cut if the results of the trial so indicate.



Tools Required When Blasting Stumps



- A. Steel bar $1\frac{1}{2}$ inches in diameter, 5 feet long, either round or octagon, swedged to 2 inches diameter just above the pointed end.
- B. Wood auger with ball-bearing crank handle.
- C. Wood auger 5 feet long, and extension section, with bit $1\frac{3}{4}$ or 2 inches in diameter.
- D. T-punch bar 3 or 4 feet long, $1\frac{1}{2}$ inches in diameter with 20-inch handle.
- E. Soil auger 5 or 6 feet long, bit $1\frac{3}{4}$ or 2 inches in diameter. Tamping stick to pack explosives in place.

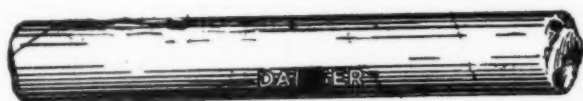
Fig. 802. Stumping tools and location of stump charge



No. 6 electric blasting cap.
Wires of different lengths
to suit different depths of
bore holes.



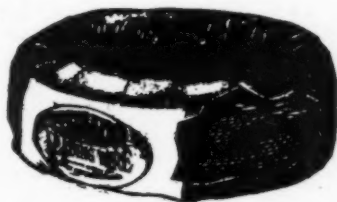
Electric blasting
cap (section)



A 1 1/4 x 8-inch dynamite cart-
ridge is used as a standard in
this handbook.



Connecting wire



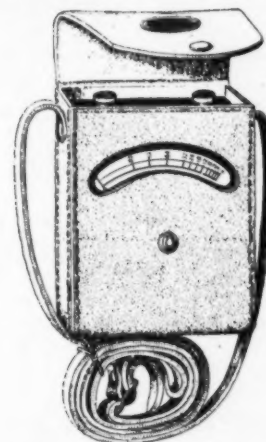
Roll of
leading wire



Single leading wire



Duplex leading wire



Galvanometer or circuit
tester with carrying
case and strap.



Push-down blasting
machine



Pocket blasting
machine

Fig. 804. Electric blasting equipment

If the stump has a tap root, the charge must be placed well under the center of the stump and against the tap root.

If the stump is on level ground, place the charge under the strongest part of the root structure.

If the stump is on a hillside, always place the shot under the upper side of the stump so that the impact of

the hillside will give more impetus to the shot.

To shoot large stumps over 30 inches in diameter, it often pays to put in 2 or 3 light charges rather than to put in one big charge which is costly to place and may be much less effective. The nature of the root system and soil condition will determine the most economical method to use.

Do not spring the hole unless there

is no other possible chance to get a hole down under a stump. Springing loosens the ground under the stump and lessens the effectiveness of the charge. Too heavy springing may shoot all the dirt away leaving the stump high and dry, still tightly imbedded by the roots.

Stem the hole with mineral soil to prevent the charge blowing out. Use a wooden stick or a pick handle for tamping.

F. Blasting of Ditches

Ditching with explosives is economical when it is impractical to do the work with grading or other power equipment. The conditions of the ground to be ditched with explosives must be carefully examined to determine which method should be employed. There are two recognized methods; a, propagation for wet ground, and b, electric for dry ground. In the latter case, each load must contain a primer and be fired simultaneously.

a. Propagation. For propagation the ground must be wet. If water can be squeezed out of a handful of the soil it is wet enough to carry the propagation wave. A single row of holes 18 inches apart with the charges not more than 1 foot below the surface of the ground, loaded with one or two sticks of explosive, will excavate a ditch having a bottom width of 2 feet, side slopes of 1 to 1, and a depth of 18 to 24 inches. In other words, the loads should be placed at a point one-half to two-thirds the depth of the desired ditch depth. Explosives of type A, class 1, 50 percent; class 3, 60 percent; and class 4, 40 percent; and type B, class 1a, 40 percent, classes 1a and 1b, 60 percent, are recommended for propagation work. See table 800. For larger ditches, the charges should be increased. Where 3 to 5 sticks of explosive are required, the charges should be placed 2 feet apart. Use parallel holes wired in series connection for wider ditches. See figure 805.

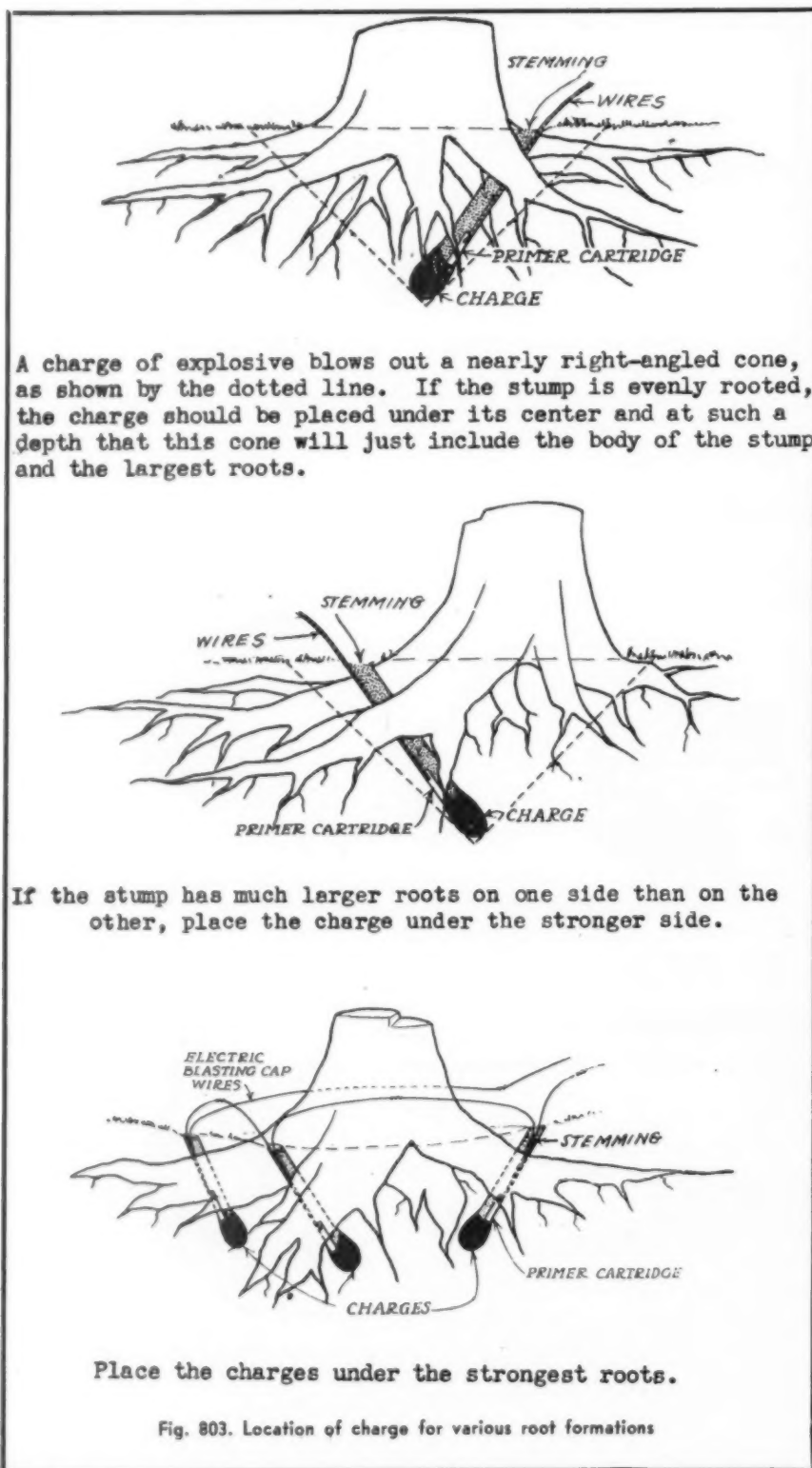
In the relief method, two side lines of holes are fired first. These two ditches assist the main central charges by taking a part of the material.

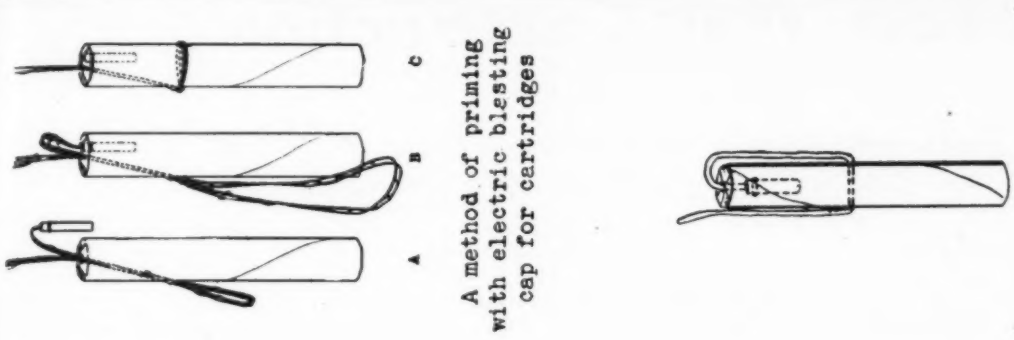
In the post-hole method for shooting wide deep ditches, where each hole uses from 20 to 100 sticks, the holes should be placed approximately 6 feet apart.

b. Electric method. In dry ground the charges must all be primed and shot simultaneously.

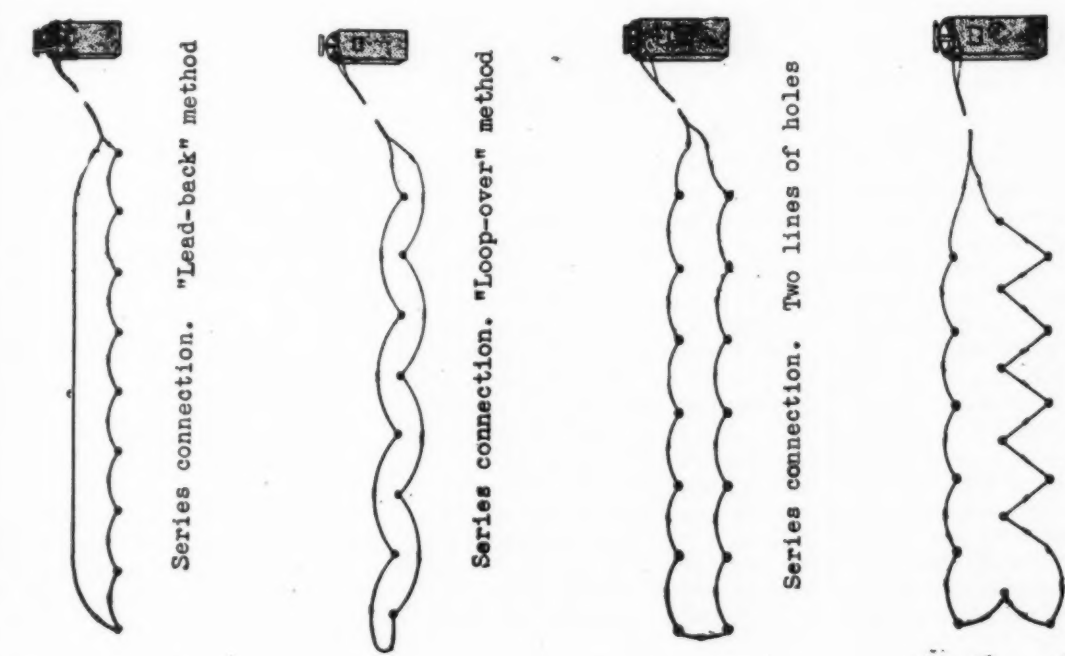
All shots in frozen ground should be fired electrically. Dynamite should not be loaded below the frozen limits but within the frozen layer.

(Continued on page 88)

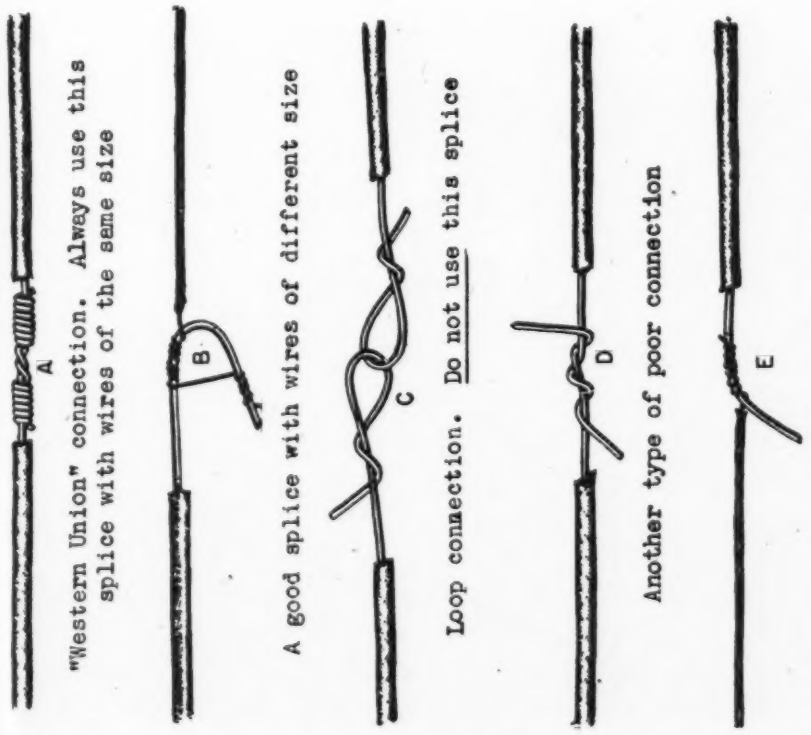




Make primers with electric blasting caps so that the wires do not cross. This method preferred.



Series connection. Three lines of holes.



Splice A, known as the Western Union splice, is ideal and should be used where and whenever possible. Western Union splices are difficult to make with two wires of unequal size. Twisting the wires as in E will make a splice easily pulled apart. A good splice for wires of different size is shown in B. Splice C is sure to give trouble and with presence of a little dirt on the wires may become practically equivalent to a break in the circuit. Splice D, while better than C, is poor and is sure to add materially to the resistance of the circuit.

Fig. 805. Priming, wiring, and series connections

Post War Construction

Statements from State Highway Officials Regarding Their Plans for Highway Work After the War Is Over

Connecticut

Assuming that the legislature grants us the necessary appropriations we are laying plans to design during the next biennium some \$30,000,000 worth of road and bridge projects. This would represent about three years' normal program.

The program on which we are working covers the whole range of our highway responsibilities from a reconstruction of portions of U. S. Route 1 (the Boston Post Road) and the extension of the Wilbur Cross highway at one extreme to purely local "town" roads at the other. Emphasis will naturally be placed on projects of the more important sort.

The Wilbur Cross Parkway is an extension of the Merritt Parkway, which was opened to use in 1938, and when completed will result in our having a modern four-lane divided road, much of it with restricted access and with all grades separated, diagonally across the State from the southwest to the northeast. This will be suffi-

ciently deflected from a straight line to serve satisfactorily the heavy Connecticut inter-city travel as well as the New York-Boston route. By the end of the next biennium we hope to have the entire design complete and to be in position to carry out the construction as rapidly as funds become available.

The Boston Post Road paralleling the Connecticut shore is out-moded and over-loaded particularly through the western third of the State. Extensive reconstruction or replacement of this road is now being studied, and we hope by the end of the next biennium to have substantial portions of it designed and ready to be put under contract. The same thing is true of Connecticut Route 8 connecting our cities of Waterbury and Bridgeport. We have in mind very extensive betterments of means of access to the capital city of Hartford from north to south and also from east to west. An east-to-west bypass of the City of Waterbury is under active considera-

tion, as well as a large number of lesser projects on the more important roads in various parts of the State.

All of these projects are intended for post-war construction when and if funds are available. The date we have in mind for completion of designs of the projects now programmed is the end of the forthcoming biennium.

Delaware

During 1942 the State of Delaware completed approximately five miles of highway. We are making surveys and plans for securing right-of-way for the extension of our dual highway system. Also for the reconstruction and improvement of the oldest main highways, now more than twenty years old, as well as for building several bridges and cut-offs on the old strategic system.

While we are carrying out extensive plans, the actual program will be governed by federal and state funds available during the post war period.



A foretaste of things to come in American post-war days is Detroit's new Davison Highway—a limited access route which removes a cross-town bottleneck and provides non-stop travel for metropolitan traffic. Opened late in 1942, its advanced design and boldness of conception will undoubtedly have an influence on similar projects needed in scores of other congested areas.

We have estimated that our needs are as follows:

Resurfacing old pavements, 170 miles	\$3,400,000
Widening narrow pavements, 84 miles	920,000
New construction and bridges, 65 miles (approximately)....	6,000,000

Idaho

Idaho post war highway planning is getting under way, not only through the selection of Highway Advance Planning, but under a favorable administrative attitude toward statewide planning. The impetus given to the development of strategic and other metals is to be sustained by every possible means as a basis for State industrialization.

Advance Engineering highway projects covering 185 miles are in course of preparation for submission to the Public Roads Administration. The proposed projects include nine grade separations, seven river bridges, the longest being 4,500 feet, and seven by-passes.

The preponderance of structures results from the fact that the sections being improved are now inadequate because the structures were avoided in the first instance. The design of these structures with limited personnel will delay the preparation of plans. In the design the question of materials will arise as there is no telling how soon after the cessation of hostilities the most economical materials will be available. On the other hand, plans made under war limitations of materials will be voided.

If it is a long war, deferred maintenance to be done will be very extensive before even normal traffic can get under way. State funds for this work will be very limited after years of diminished motor vehicle income, and so will leave nothing for betterments. The increasing limitations on traffic movement make a sinking fund very remote. If Federal funds are required for all betterments, it is possible that the Federal-Aid Highways may become Federal Highways.

The question that underlies the situation of after-the-war projects is how well the highways can be maintained during the war. This, in turn, depends on whether we can get repair parts for our machinery to carry on the necessary maintenance work. The extent of all operations depends upon a Federal clarification of this situation.

Illinois

Unless the war should end very soon, Illinois will not immediately have any sizeable amount of high-

way funds to devote to post-war construction. Therefore, the size of its post-war program will depend almost entirely upon the amount of Federal funds which might be made available for that purpose. While information on that point is lacking, we have proceeded with a detailed study of the needs of our highway system, and have formulated a tentative program of post-war projects.

This tentative program contemplates an expenditure of approximately \$100,000,000 for necessary reconstruction and modernization of the primary road system, consisting of 701 miles of two-lane pavement, 110 miles of four-lane pavement, 66 miles of miscellaneous pavement, 75 miles of medium-type surfacing, 115 miles of advance grading, 100 railroad grade separations, 14 highway grade separations, and 165 bridges. It also includes 159 miles of secondary roads of various types, estimated to cost \$2,900,000. This latter item consists only of improvements to be made by the State, and does not include any which might be undertaken by the counties.

Some design work has already been completed on this program. Additional surveys, plans, and right-of-way acquisition will proceed as rapidly as available engineering personnel will permit.

There is a considerable number of large projects which, because of their importance, expense and complications, will require careful preliminary study before construction plans can be undertaken. The State proposes to utilize Federal funds allotted for advance engineering surveys in conducting these studies. The projects involved will require an ultimate expenditure of some \$250,000,000 by the State. While construction is expected to be spread over a number of years, some projects may be ready to proceed shortly after the war.

Indiana

To meet Indiana's post-war traffic needs, the highway commission has outlined to the legislature an extensive development and improvement program. Over \$160,000,000 in roads and bridges is involved, embracing a mileage equal to nearly one-half the present state system.

This program, representing a decade of normal construction volume, takes in jobs started but held up by the war. It will include replacement of old narrow bridges and other projects necessary to eliminate conditions which now contribute to accidents or impede traffic flow.

Completion of the 60-mile belt line around Indianapolis, now about three-fourths built, is early on the list.

Iowa

We are proceeding to the best of our ability with the engineering force which we are able to keep together, in the making of surveys, the preparation of plans, and the purchase of right-of-way for post-war highway construction, in order that we may be ready when the war ends with a substantial number of highway projects ready for immediate construction.

We are unable at this time to give any estimate of miles of different types of construction or probable cost.

Kansas

We have been making surveys and preparing plans to the utmost extent of our available engineering man power for some time.

At the present time we have completed 424.8 miles of surveys, representing an estimated construction cost of \$16,760,000, but plans have not yet been made on this mileage. We have 200.6 miles of surveys and plans complete, representing an estimated construction cost of \$8,836,318. We also have 254.4 miles of surveys with partially completed plans, representing an estimated construction cost of \$11,439,000. There are 139.1 miles of surfacing work which could be quickly put under contract and which needs no surveys but only plans, which could be quickly prepared, with an estimated construction cost of \$3,340,000. We have also recently received approval on our program for advance engineering, as authorized in the Defense Highway Act of 1941, and are working on surveys and plans covered in this program.

By the end of 1943 we will have completed plans covering several years of normal highway and bridge construction and will be in a position to immediately start letting contracts for post-war work, the amount to be let depending upon available finances.

Kentucky

We have secured approval for a program of surveys under the recent Highway Defense Act which covers a number of projects. These include a belt line around Louisville, Paducah and Lexington; numerous major relocations on U. S. 25, which is a strategic highway and one of the main north and south roads across the

State; and some relocations on U. S. 60, our main east and west highway.

Some of these surveys are in progress and more work will be done on them this winter, utilizing many of our construction engineers during the winter season. Prior to the passage of the Defense Act, we had also completed additional surveys for the correction of obsolete sections on other main roads. It is our intention to push these surveys with all forces available and complete the plans. We expect to have a normal two- to three-year program of surveys and plans ready for immediate letting when the war restrictions are lifted.

Maine

With the engineering force available during the winter, we are planning to complete plans for as many projects as possible. We estimate that by spring we can have plans ready for bridge projects which we estimate will cost approximately \$1,560,000 and for highway projects which we estimate will cost \$9,150,000 and which would include approximately 178 miles, of which 125 miles are located on our Federal Aid highway system and 53 miles on our secondary Federal Aid highway system.

Maryland

The State Roads Commission of Maryland about two years ago adopted an extensive program of construction work originally intended primarily as Federal Aid programs. The contemplated work includes major relocations or portions of existing main arteries and the construction of a number of bridges, including the elimination of several railroad grade-crossings.

As the country moved toward war, a \$15,000,000 program of military access highways was substituted and former projects laid on the shelf. All access roads in the new program are completed or under construction. The Plans and Surveys and Bridge Departments are, therefore, moving into the position where unless additional access roads are requested, we will be able to take up again the preparation of plans and specifications and the acquisition of rights-of-way for the aforementioned Federal Aid and State programs.

Approximately 240 miles of new highway construction is contemplated, to cost about \$25,000,000, of which about \$4,000,000 could be released at once.

This program includes a number of

major projects urgently needed for many years.

Outstanding among these is the proposed new highway between Washington and Baltimore which includes a new passage through the City, as well as the means for bypassing through traffic traveling between Washington, Philadelphia, and New York. The by-pass will include a \$12,000,000 bridge across the Patapsco River.

It is planned that the new Baltimore and Washington road shall be a most modern type four-lane divided highway with all major highway grade crossings separated and to be operated as a freeway.

Another major project is the continued extension of an arterial high-

way throughout the major portion of the Eastern Shore peninsula.

Other major projects are on U. S. Route 40 and other arterial routes, at points where relocations have long been needed.

With such plans and specifications completed and rights-of-way secured at the termination of the war, the State will be in a position to undertake on a large scale long needed and substantial improvement of its entire arterial system.

Massachusetts

At the present time we have projects totalling between 10 and 12
(Continued on page 62)



Heavy lines show proposed reconstruction or improvements involving nearly half of Indiana state highway system

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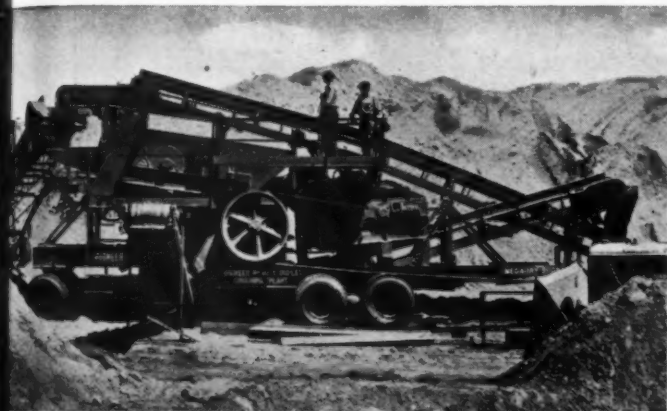
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miles, estimated to cost approximately two and one-half million dollars, which could be advertised at once in case the war was to end suddenly. These projects consist of grade crossing eliminations, and work on the strategic system, some sections of which call for double-barreled construction.

Furthermore, we could get ready in a period of about ninety days 20 or 25 miles additional, estimated to cost about three and one-half million dollars. This second list would include sections of double-barreled roads, bypasses, grade crossing eliminations, and some flood road contracts, which were postponed since the war.

Within ninety days we could advertise approximately 30 or more miles of road construction estimated to cost six million dollars.

Minnesota

Prosecution of post-war planning has been subject to the effect of the war upon the Highway Department's trained personnel. To date this Department has contributed approximately three hundred to the nation's armed forces and an even larger number to war production, construction or transportation. Remaining technical and engineering forces, in excess of those required for supervision of a materially reduced construction program, will be used to a large extent on surveys and the preparation of plans for post-war work.

We hope to complete plans for the following:

Type of Work	Number of Miles
Grading	500 to 700
Stabilized Base and Bit Surface	300 to 500
Concrete Paving	175 to 250
Bridges	30 to 45

This program, with related minor items of work, is estimated to cost \$25,000,000 to \$35,000,000. In recognition of these financial requirements, the Minnesota Highway Department has established and is striving to increase a Post-War Highway Construction Reserve Fund. Providing Federal Aid balances now credited to Minnesota's allotment are not disturbed, and it does not become necessary to draw extensively on this reserve for current expenditures, the State anticipates accumulating in advance upwards of \$13,000,000 in combined State and Federal funds for the post-war construction program.

Mississippi

The state highway department has several survey projects authorized

which would involve considerable construction on some of the main trunk lines on the state highway system.

Our forces are very limited and we are unable to accomplish preparation of any appreciable quantity of completed plans covering post-war projects. We do not believe that there will be much delay, however, in preparing plans for such a program when the war is won provided, of course, we are able to secure the services of most of our former employees.

Missouri

Normal planning activities of the Missouri State Highway Department have been completely upset by the war.

The decline of revenues under gasoline rationing and the drop in the motor registration that is certain if the war is prolonged, as well as the inflationary trend of prices of materials and labor, makes post-war planning of highway construction problematical.

Programs prepared for 1943 construction on the basis of pre-war traffic trends, which would ordinarily serve as a stock pile of completed plans for immediate execution, will no longer be completely usable.

In general, major roads continue to carry a great volume of truck traffic and greater average loads. Many of these more important heavy traffic roads were constructed early in the highway improvement period and have already reached a dangerously high state of deterioration. In such cases it is assumed that deterioration will be accelerated by the war-time necessity of heavy freight movements.

On the other hand, medium and low traffic roads show a reduction in traffic and traffic loads, and certain improvements scheduled for early construction may now have to be postponed.

In view of these conditions our planning efforts are now being concentrated on major routes and advance planning projects authorized under the 1941 Defense Act.

The latter projects are generally confined to cities and metropolitan areas, the most important ones, of course, being in St. Louis and Kansas City. A shortage of manpower at this time makes for slow progress. . . . The only definite statement that can be made now is that the Missouri State Highway Department will make every possible effort to be prepared for any condition that may exist after the period of this emergency.

Nevada

A very definite construction plan, looking into the future for several years and including the coming biennium, has been under study and consideration.

Highway construction and reconstruction proposed for the biennium 1943-1945 would embrace Federal Aid, Federal Aid Secondary, Federal Lands Highways, and Grade Crossing Elimination projects, and should be considered a part of a six-year improvement program for Nevada.

No allotment of Federal Aid Funds has been made by the Congress for the fiscal year 1944-1945. Nevada's holdover or balance of federal funds as of January 1, 1943 amounts to \$1,332,733.66 broken down as follows: Regular Federal Aid \$466,977; Federal Aid Secondary \$220,763.96; Federal Aid Grade Crossings \$203,388.70; Strategic Net funds \$314,065; Advance Engineering \$127,539.

It appears that only certain of these funds may be available for construction during the calendar year 1943, if projects are selected and certified by one of the government agencies above named.

The 1943-1944 portion of the tentative six year program embraces 479.04 miles of highways at an estimated cost of \$10,240,388. It involves 45 projects including roadway construction, grade crossing elimination projects, realignment, widening of existing highways, improving surfaces and shoulders and, in general, bringing Nevada's highway system closer to the accepted federal standards as designated by the Public Roads Administration.

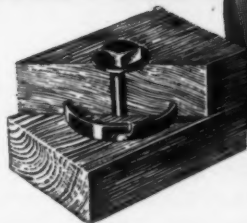
Projects are located in nearly every one of the 17 counties. They embrace lengths ranging from 0.7 of a mile through the town of Verdi, at the gateway to California on U S 40, to a stretch embracing 68.6 miles from the Pershing County line to the small settlement of Vya, on a state route. All of the projects on the transcontinentals would probably come under the hard surface type designation. In this tentative program 18 projects directly affect the transcontinental networks, principally U S 40 (The Victory), U S 91 (The Arrowhead Trail); and U S 93 (International Four States Highway) with a total estimated cost of \$5,411,000.

Seventeen projects on the Federal Aid Secondaries, which could be classified as "other types" of surface, involve an estimated cost of \$1,867,520. Nine other units listed under the classification of F.L.U.S., F.L.S.R.,

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and F.L. F.A.S. are estimated at \$2,295,000.

In the above group one project in northwestern Washoe County is classified as an F.L.F.A.S. with a length of 15.6 miles at an approximate cost of \$187,200. One grade separation project is listed, this being through Reno, where railroad tracks would be depressed for a distance of 9,513 feet to eliminate mid-town traffic congestion. This involves an estimated cost of \$666,668.

Under Maintenance and Operation for the biennium covering two fiscal years from July 1, to June 30, inclusive, for 1943-1945, the estimate is as follows:

Administration \$250,000; Maintenance \$1,500,000; Surveys \$350,000; Equipment \$300,000; Other disbursements \$500,000 with a total of \$2,900,000.

Nevada's Board of Highway Directors for the coming biennium will have a change in personnel. Two members of the Board, by virtue of re-election to their respective state administrative offices, retain membership on the Board. One new face will be seen at board meetings in 1943. This will be the new Attorney General of Nevada, who was elected to that post during last November's elections. He will displace former Attorney General Gray Mashburn, who has retired from political life in the state.

New Hampshire

We have not any program, as yet, for post-war construction. We are working up some plans on our strategic network of highways, and have submitted a program to the Public Roads Administration for some extraordinary highway work in by-passing some of our congested centers.

However, the plans are not ready, and it will require at least six months to get anything on paper insofar as this program is concerned.

North Carolina

We started some time ago to make plans for a post-war program. However, about that time, many engineers began to leave us for the armed services, war industries or other war projects at salaries we were not in position to pay. As a result of this condition, we have been unable to make much progress in surveys and plans on future projects.

In addition, due to reduced revenues from gas and tire rationing, we will not have sufficient funds for the next biennium to take care of fixed

charges on bonded indebtedness, and to do more than is absolutely essential for the basic maintenance of the 60,000 miles of our State and County roads. If it was not for the fact that we have built up a considerable surplus in our highway fund, in anticipation of very materially reduced revenue, the funds would be entirely inadequate to do a reasonable job of maintenance. Our plan is to continue with surveys and plans on future projects, as rapidly as possible, with the hope that funds will be provided in some way after the war to carry on a substantial construction and reconstruction program.

Ohio

The Ohio Department of Highways has awarded during 1942 the following construction work:

- (1) Access roads, 40.9 miles at a cost of \$8,606,044.00.
- (2) Strategic network projects, 23.2 miles at a cost of \$4,689,057.00.
- (3) Other new construction, 19.7 miles at a cost of \$1,294,539.00.
- (4) Salvaging existing pavements by surfacing and widening where necessary, 1301.9 miles at a cost of \$8,515,188.00.

Although we do not yet have a definite program, we believe that funds should be available for a program about 70% as large as that of 1942.

Recognizing the fact that the Highway Department may not be in a position to obtain approval for many needed construction projects until after the existing national emergency, we have made a very thorough and complete survey of the condition of our present highway system, and prepared a program classifying all projects in one of the following:

(1) Widening and resurfacing projects. These projects we propose to construct in 1943 with current revenues, and using such materials as are available for this type of work.

(2) Construction projects, which normally would be financed by State, Federal Aid, and Federal secondary funds. These projects are of a nature that would be constructed as a part of our regular program in normal times. However, because of the present emergency they will be delayed for financing and construction as post-war projects.

(3) The replacement of needed structures on both the State and Federal Aid highway systems. These projects, except in cases of emergency, will be delayed for financing and construction as post-war projects. Because of critical materials involved

this type of work is almost impossible to accomplish at the present time.

(4) Studies and developments of advanced planning program involving projects of importance that will facilitate urban traffic. Projects of this nature could not be financed by normal allocation of the State and Federal funds; however, we have prepared a program for this type of work, and we have submitted the same to Public Roads Administration for their consideration and approval. We hope to get these studies and plans under way in the near future.

As will be noted numbers 2, 3, and 4 on our program involve practically 100 per cent post-war construction. Under number 2, our program consists of developing plans and estimates for approximately 130 miles at an estimated cost of approximately \$70,000,000. Under number 3, we propose to develop plans for 108 structures at a cost of approximately \$11,000,000. Under number 4, we have submitted to Public Roads Administration a request for program approval of \$700,000, to be financed 50-50 by the State and Federal government to make preliminary studies and develop plans for approximately 162 miles of highways that will probably cost from \$80,000,000 to \$100,000,000.

Oklahoma

In the early part of 1942, in response to a request from the Federal Works Reserve, the following projects were listed which could be begun at once and extended into the post-war period. The first group are the most essential:

Group No. 1.....	\$15,703,550
Group No. 2.....	15,409,050
Group No. 3.....	16,139,000
Group No. 4.....	16,423,200
Group No. 5.....	16,739,278
Group No. 6.....	14,868,500

Total\$95,282,578

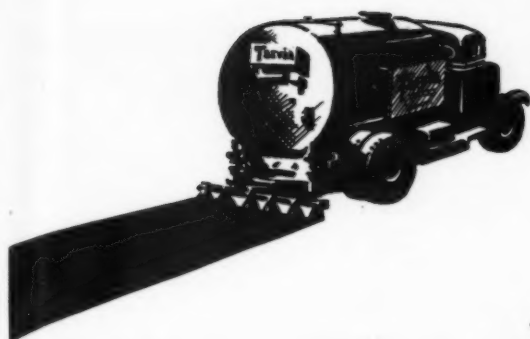
Grade, Drainage and Small	
Bridges, 1692.0 Miles.....	\$19,624,228
Concrete Paving, 440.3 Miles...	13,145,600
Bituminous Paving, 2519.4	
Miles	31,830,350
Bridges	25,730,400
Grade Separation	4,952,000

Total\$95,282,578

Oregon

The State Highway Commission is at present working on post-war plans for a 3-year highway construction program comprehending the expenditure of up to \$50,000,000, if such amount be available. In the main, funds for such a major program must come from the Federal Government

(Continued on page 70)



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Editorial

A Start Toward a Post-War Program

IN THIS issue of *ROADS AND STREETS* a number of highway officials tell the status of their post-war programs.

Due to varying circumstances, some states have only begun to make progress. Others have been able to go after this task vigorously in spite of reduced engineering departments. Already 20 states have received Public Roads Administration approval for advance engineering projects designed to produce completed plants for post-war construction. Four other states have projects under consideration. When peace comes these states will be readiest to begin repairing the damage resulting from postponed maintenance and replacement. They'll be out ahead with new developments.

Nationally a \$3,000,000,000 backlog of state work looms; these reports only partly reveal the sobering immensity of the post-war job. Seventeen officials able to give figures list over a billion dollars in work. Some of the states, including New York with a future program understood to be over \$600,000,000, have not reported. Additional billions must be expended by cities, counties and other local authorities. Chicago's \$200,000,000 super-highway program is but one example.

But the post-war problem cannot be measured in dollars. It is one of over-all planning.

True, there must be a docket of ready-to-go construction and reconstruction jobs. Certainly in the period of transition from war to peace a large public works program will be needed to restore war-worn facilities, provide for new patterns of populations, and help take up any slack in employment. Acquisition of rights of way and other time consuming phases of immediate projects should be pushed.

But over and above the immediate tasks looms the more fundamental one of relieving metropolitan congestion and of integrating state and local road development with a soundly conceived inter-regional program.

"It should be clear," said G. Donald Kennedy in his President's address before the A. A. S. H. O. in December, "that the tremendous difficulties which we are all encountering should not divert attention entirely from the long-range problems and objectives toward which we in the field of highway transportation are all working."

Mr. Kennedy, who since has joined the Automotive Safety Foundation as vice-president for highway

transportation, went on to make these significant statements:

"In addition to taking care of accumulated construction and maintenance needs, the highway departments must go much further in their post-war planning to fit their future operations into the transportation pattern expected to develop from wartime changes in transport technology. The highway engineer must be prepared to coordinate with the newly developing air transport industry. He must be ready to provide better service at lower costs if he hopes to maintain his place in the transportation system.

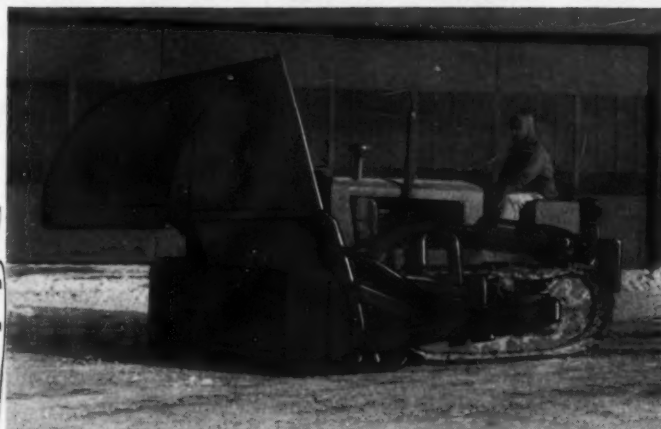
"The highway departments must recognize that highway problems no longer exist only in rural areas, but that the problems of the urban areas now constitute a primary obligation in many states. It would not be an exaggeration to state that unless our highway departments wake up to the realization that emphasis in highway problems has shifted to the city, the job of providing needed highway facilities will be done by somebody else.

"Another point is the necessity for adopting truly modern highway designs and the abandonment of the over-cautious designs often the tendency in the past. The future main highways can no longer follow the trails marked out for the horse and wagon. In many cases, entirely new locations must be selected for future highway facilities. These locations must incorporate all the design improvements with which the highway engineer is familiar but which he has often failed to develop to the maximum extent . . . including the divided highway, the separation of cross traffic, the protection of the right of way from the encroachments of adjacent property, and the provision of passenger car and commercial vehicle terminal facilities as part of the highway transportation network.

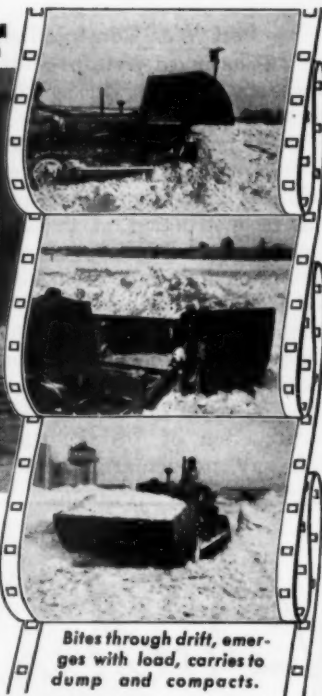
"Let us be ready, therefore, with soundly engineered programs for the post-war work crisis—with new road designs and standards to fit the designs and standards of the revolutionary motor vehicles that will roll off the mass production lines after tanks and guns and war planes no longer are needed."

To date not all of the states have matched their allotments of the \$10,000,000 provided for advance planning by the Highway Defense Act. It is hoped that they can find a way to do so as rapidly as war conditions permit. Eventually many times \$10,000,000 will be needed and it will be a bargain investment to the American people.

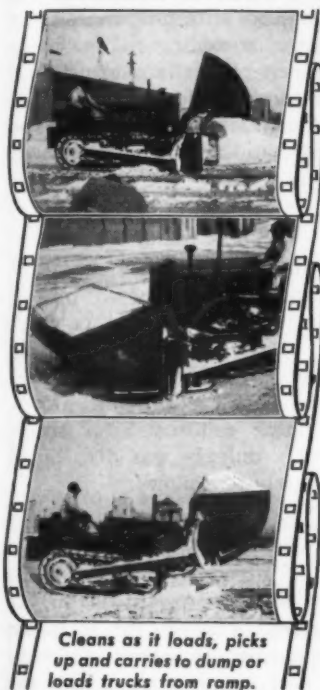
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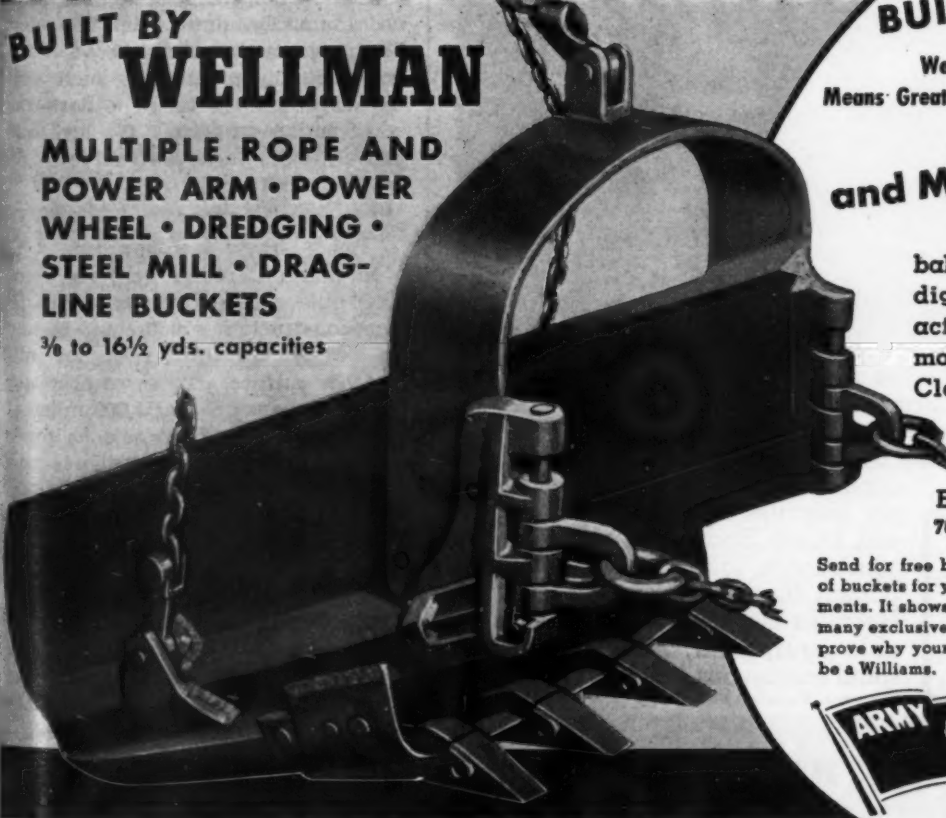
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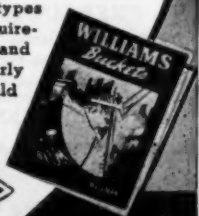
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Post War Construction

(Continued from page 64)

since state funds will by that time barely maintain the system.

The Commission is taking advantage of federal funds that have been made available for surveys and plans for the reconstruction of certain roads included in the so-called interregional system of highways. Included in such plans are the reconstruction of sections of US 30, the Columbia River Highway and the Old Oregon Trail, particularly the section between Troutdale and The Dalles, and the reconstruction of US 99, the Pacific Highway, particularly the section in

the Southern Oregon mountains.

Indications are that the Federal Government will require that most funds go to improve heavy-traffic arterials and to provide better routes through cities, particularly large metropolitan centers such as Portland. As fast as more information is known about the type and character of projects that the Government will require, changes in the plans will be made in accordance therewith.

In addition to this the Highway Commission will complete surveys and plans for many other roads which are not on the interregional system but

which are manifestly needed to provide better transportation facilities to encourage the economic development of the state.

When the war is won this problem will be immediately at hand and there will be no time then to make orderly plans. Plans must be made now. Preparation of detailed plans for the contracting of a large program of public works, including highways, to give employment in the readjustment period requires considerable time and should have immediate attention. The Highway Commission is making plans accordingly.

Rhode Island

Some time ago we outlined a tentative summary of proposed project estimates for a so-called "six-year" program. This program comprised approximately 191 miles of construction and reconstruction and widening, including military area access roads. This mileage was distributed approximately as follows:

- 46 Miles Widening
- 107 Miles Reconstruction
- 38 Miles New Construction
- 13 Miles Bridges
- 8 Miles Grade Crossing Eliminations
- 8 Miles Military Access Roads

The estimated cost of this proposed work amounted to about \$25,250,000. A very small proportion of the work has been completed, about ten miles of construction and reconstruction.

With the completion of this season's construction operations, we anticipate no resumption until after the war. The program as outlined above, while not originally planned as such, can be adapted to serve as a post-war construction program. We are tentatively going ahead with surveys and plans on that basis.


South Carolina

In South Carolina we have some 4,600 miles of State highways of earth type construction which could be and should be provided with an all-weather surface. To serve post-war traffic perhaps another 3,000 miles of our now existing hard surface roads will need modernizing. Entirely new roads will be needed as access and service roads to our airports, which undoubtedly will play a big part in our post-war transportation facilities.

If the war lasts two years longer, or even one year longer, and the present restrictions on materials and manpower continue as acute as they are now, a large amount of special maintenance work will be needed to restore thousands of miles of our roads to a satisfactory condition.

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Unlike some other public works requiring long periods of advance study and plans, our preliminary highway plans will require practically no time before we could get the work started once we get the go ahead signal.

Offhand, it can be stated that with finances arranged—and the South Carolina State Highway Department's financial condition is extremely good—we could easily and efficiently carry out a construction and special maintenance program of forty million dollars during the first two or three years following the close of the war.

Texas

The Texas Highway Department proposes to outline a post-war program, and have plans and specifications ready for immediate construction of more essential projects when materials and labor become available.

It is planned to prepare estimates for a program to cost approximately \$200,000,000, with the objective of completing all the proposed construction within a five-year period. The expenditure of \$40,000,000 per year would be somewhat in excess of the normal Texas expenditure of \$30,000,000 for highway construction, exclusive of maintenance. If conditions require, it would be practical to expend the total program amount in a shorter period of time, if Federal funds were made available to pay for the larger than normal expenditure.

The work will cover the range from multiple-lane highways near metropolitan areas to minor traffic service roads in thinly populated areas. Therefore, the cost per mile will probably vary from nearly \$100,000 to under \$10,000. Small and large projects of all types, and railroad grade separation and highway grade separation structures, will be included.

As an example of the trend of the first estimates, the first eighty projects, located exclusively on the principal through highways and therefore, probably of greater than average cost, include 435 miles of construction which is estimated to cost \$15,218,000. The entire program naturally should reflect a substantially lower average cost per mile.

Washington

After the war, it is anticipated that a period of expansion in all lines of construction activity will be witnessed which will surpass anything heretofore experienced.

A study of post-war needs is being made, covering the huge back-log of normal deferred construction as well as new facilities sure to be needed.

Although this study is by no means

completed, it is indicated that it will cost about \$130,000,000 to bring up to adequate standard the present system consisting of 3761 miles of primary and 2222 miles of secondary State highways. This tremendous cost is due in part to the fact that in recent years development of the standards of roads making up the highway system has not kept pace with the recently increased volume, weight and speed of traffic. War conditions and the establishment of new war industries have also changed the travel characteristics on many of our highways. This in turn has advanced the necessity for reconstruction of many

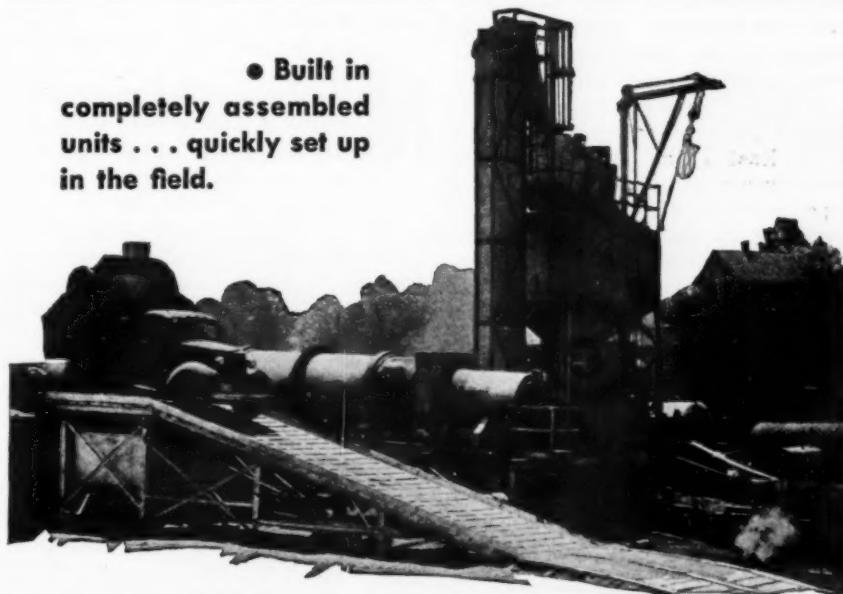
roads to higher standards than heretofore necessary.

It is not expected that such a program as outlined above can be financed in a short period of time. A hasty review of this proposed post-war program indicates that projects totaling about 1800 miles in length, estimated to cost some \$50,000,000, is of immediate concern, and that their financing may reasonably be expected after the present emergency.

West Virginia

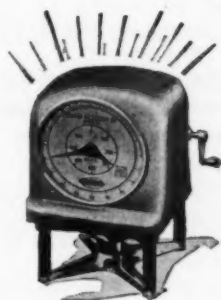
We have on hand developed plans sufficient to provide a construction program of some \$8,000,000 of which ap-

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proximately one million is for bridges. This represents more than our normal annual expenditure for construction. In addition to these completed plans we have in various stages of completion surveys and plans representing construction cost of approximately seven million dollars, of which about \$1,500,000 is for bridges.

A program of projects to be surveyed and planned with funds allotted under the Defense Highway Act of 1941, was submitted to the Public Roads Administration for approval some time ago. About fifty-five percent of the program was approved, so that we may be able to proceed with this work as soon as survey crews are available. Approval of the balance of the program will be secured as soon as practicable.

With our present depleted engineering forces it will probably take us at least 18 months to complete these surveys and plans. However, we hope to have a sufficient program completed by the end of the war to provide about three years of construction work at our normal rate of letting contracts.

Wisconsin

Post-war state highway effort has been confined to the development of plans for projects for which financing is initiated by the current normal accrual of funds. The scheduled program, which will result in a \$22,000,000 reservoir of construction, is made up of projects planned for the normal orderly development of the highway system within ordinary fund limits. Financing of such program would contemplate normal annual accrual of federal aids and bonds by counties in addition to the state funds currently available and allotted to the projects.

The personnel of the department is at the lowest level in a decade, and preparation of detailed plans for projects under current docket will keep such personnel employed well through the coming year. . . . Presently, at least, it does not appear practical to initiate planning of a special post war program in expectation of special post war federal grants or aids. It is conceivable that the end of the war will find our state highway system so run down by deferred maintenance that all resources will be necessary for a general refurbishing or betterment program of such system to restore the same to a state for general use. Preliminary studies are also being made of all distinctly sub-standard bridges on the state system. Reconstruction and replacement of such structures might make a most desirable special work program.

Vermont

We expect there will be an enlarged highway program after the war is over. We are using what resources

we have at our disposal in getting plans ready for projects for this program. We have no way of estimating at the present time the magnitude of this program.

Tests on Soil Stabilized with Asphalt or Tar and Treated to Permit Wide Range of Moisture

SOIL stabilization (both field and laboratory) with asphalt and tar treated with "Kotal" and lime have been tested to date only by the McKesson extrusion test. This test has not yet been fully correlated with field practice but serves adequately as a means of stability comparison only.

Herbert P. Pearson, Technical Director of Kotal Company, was called in by Haller Engineering Associates for Pan-American Airways to see if a cutback asphalt stabilization with "Kotal" waterproofing would be an improvement on stabilization with asphalt emulsion alone. Regarding the investigation, Mr. Pearson reports as follows:

A Brazilian graded soil was selected having the following screen analysis:

Retained in No. 4..	20.8%
Retained in No. 16..	25.0%
Retained in No. 30..	33.0%
Retained in No. 50..	50.1%
Retained in No. 100..	75.8%
Retained in No. 200..	84.2%
Passed No. 200.....	17.8%

Samples of this soil were prepared containing 7%, 12% and 18% of water, and each sample at 70° F. was mixed in a pan according to the following formula based on 2,000 grams of soil:

1. 16 grams hydrated lime;
2. A solution containing 12 grams kerosene and 2 grams "Kotal";
3. 4% of RC-3 at 150° F.

The following were the observations using the McKesson extrusion test:

	Water absorbed as percentage of required to	Pounds pressure extrude ½ in.
7%	1.15	26,330
12%	1.26	27,190
18%	1.34	15,490

Some time after these tests were made, the Company was invited to demonstrate in the field by the colonel of one of the army airports.

The screen analysis was as follows:

Retained in No. 4..	1.4%
Retained in No. 16..	9.4%
Retained in No. 30..	18.2%
Retained in No. 50..	64.4%
Retained in No. 100..	79.1%
Retained in No. 200..	95.4%

Passed No. 200..... 12.0%

Two hundred feet of a taxiway was chosen for the trial. The width of the taxiway was 200 ft., and 4 windrows were prepared for mixing in a Woods road mixer. Each of these windrows was wet with a different quantity of water. The optimum moisture of the soil was 8.5%. Hydrated lime was spread on the windrow to the extent of 16 pounds to the ton of soil, and RC-2 containing 2% by volume of "Kotal" was applied at 200° F., the weather being warm, sunny and windy. By adjusting the pump pressure of the machine, the delivery of the Kotal-treated RC-2 was maintained between 4.0% and 4.8% of the weight of the soil. Samples of each windrow were tested by the Haller Engineering Associates, using the same McKesson extrusion test, with the following results:

	Water absorbed as percentage of required to	Pounds pressure extrude ½ in.
6.5%	1.76	36,545
8.3%	2.49	21,245
12.5%	1.94	22,345
15.4%	1.53	25,575

After blading and compacting with rubber-tired rollers, these four stabilizations all set up fairly rapidly and, examined after a winter's freezing and thawing, were found to be all equally tough and cohesive.

The indications from these trials are that regulation of water content, which is the prime consideration in other systems of stabilization and leads to delay and expense, is not essential when "Kotal" waterproofing is added to asphalt cutback stabilization.

The preparation of the soil by pulverizing is the same as in other systems. If the soil contains much clay there must be sufficient moisture to promote the pulverization of the clay balls down to ¼-inch diameter.

An unusually rapid set-up has been observed, the liquefier of the cutback asphalt and the water vapor arising from the moisture helping each other out of the mix.

Inasmuch as C. A. Hogentogler has shown that reduction of absorption of soils to the extent of 50% by water-

proofing is in effect stabilization, there is reason to believe that the "Kotal" waterproofing can be applied with any type of cutback asphalt or cutback tar of sufficiently low viscosity to mix freely at the temperature of the soil prevailing at the time of mixing.

Prohibit Use of Alloy Steel in Dozers on Repair Parts

The use of alloy steel in angledozers or trailbuilders, in bulldozers, and in repair parts for both of these construction equipment items, is prohibited after February 1, by Limitation Order L-217, Schedules III and IV, issued by the Director General for Operations.

The basic order L-217, issued November 17, 1942, provided for the application of simplification and conservation measures to construction machinery and equipment production through the issuance of schedules affecting specific equipment.

Power control units, prime movers, and anti-friction bearings are exempted from the denial of the use of alloy steel in both Schedule III, covering tractor-mounted angledozers or trailbuilders, and Schedule IV, covering tractor-mounted bulldozers. Producers may also use such alloy steel as is in inventory or in transit to them on February 1.

Considerable saving of alloy steel used in production of these items is anticipated, particularly since their manufacture is now greater than it was in 1941.

Arkansas Court Rules on Bridge Damages

The Arkansas State Supreme Court has ruled that the state highway department is entitled to recover an amount equal to actual damages to a bridge from a motor truck operator whose loaded vehicle exceeded the specified load limit of the bridge damaged.

Automobile traffic over Illinois highways was 18 per cent less in 1942 than it was in 1941, according to Walter A. Rosenberg State Public Works Director. December 1942 showed a decrease of 44 per cent over December 1941, accounted for by the fact that gasoline rationing went into effect.

14 States Now Prohibit Motor Vehicle Tax Diversion

Citizens of three additional states, Iowa, Oregon and West Virginia, marched to the polls on November 3, 1942, and voted overwhelmingly to amend their state constitutions to require that all special motor vehicle taxes be dedicated solely to highway purposes.

Public sentiment against the use

of special highway taxes for non-highway purposes has been growing in recent years and 14 states now have constitutional amendments prohibiting this practice. Kansas and Missouri headed the parade of constitutional safeguards by adopting amendments against diversion in 1928. Minnesota followed in 1932, Colorado in 1934, California, Michigan, and New Hampshire in 1938, and Idaho, Nevada, North Dakota and South Dakota in 1940.

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Engineers In Civilian Defense Work

The Indiana Plan for Mobilization of Public Works And Public Utility Agencies for Civilian Defense

By EARL W. CASSADY

Engineering Director,
Indiana State Defense Council

THE average person is familiar with many of the phases of Civilian Defense. They know of the protective sections of the Citizens Defense Corps which include Air Raid Wardens, Auxiliary Police and Auxiliary Firemen. Many have taken First Aid courses and know the part taken by the Red Cross and Emergency Medical Services in preparation for war emergency.

Let us assume that organization and training for all the relief and protective agencies have been completed and that disaster does strike an American community. The fire and police and medical units aided by their auxiliaries go into action only to find all public works and public utility facilities severely damaged or destroyed by enemy action. Streets blocked, communication and power lines down, water and gas mains broken and transportation disrupted. Under such circumstances it is easy to believe the whole protective and relief structure might be seriously hampered.

We are all familiar with the fate of San Francisco after the Earth Quake of 1906 broke the water mains. We know that many "impregnable" citadels of the present war have fallen due, in part, to failure of the water supply. Hong Kong and Singapore are two recent examples. Pictures have been seen in most communities showing the debris blocked thoroughfares of London after the "Blitz" which made "runs" of the fire equipment and ambulances very difficult if at all possible.

War production can only function as efficiently as transportation facilities permit. The failure of the gas supply will prevent in many cases the boiling of questionable water and result in serious epidemics. Our modern civilized life has accustomed us to many service facilities which we take for granted.

All these facts point to the conclusion that the whole field of the technically supervised functions of public works and public utilities must be coordinated closely with the civilian defense preparation program.

The Engineering Program

The Indiana Defense Council, acting under the direction of Clarence

A. Jackson, State Director, instituted a program of organization to utilize to the fullest extent the technical knowledge and engineering supervised services to be found in the state of Indiana. This includes public works and utilities and is designated as the Engineering Program. A civil engineer was assigned by Mr. Samuel C. Hadden, Chairman of the State Highway Commission of Indiana, and was appointed as Engineering Director.

First to be considered was the Public Works Units, the Road Repair and Demolition Crews. Acting on the policy of the Indiana Council to utilize already existing governmental agencies as far as possible, it was decided to train all State, County and City Road and Street employees in the specialized needs of emergency work. To secure instructors for such training a series of six district road and street conferences were held in the six highway districts. State Highway, County Highway and City Street officials attended these two day conferences and received fire and gas protective training as well as heard technical discussion on preparation for structure protection, emergency maintenance and war traffic, stressing practical preparation and also conservation. Engineers from the State Highway staff, an Army officer of the Fifth Corps Area, faculty representatives from Purdue University, as well as other engineers, and representatives of the protective divisions of the State Fire Marshal's office and the State Police Department participated in the instruction. As a result 300 Road and Street officials were certified to organize and train the Road Repair and Demolition Crews. They were given a prepared set of notes, "Indiana Highways and Street Planning and Preparation," to aid in their organization.

The training of crews on the local level then started using the governmental road and street groups as a nucleus with such auxiliaries as were necessary. The training consisted of the basic O.C.D. course, three hours fire defense A, two hours gas defense

A, and a five hour general course, plus a minimum of technical discussion on emergency maintenance, structure protection and war traffic. The technical instruction was given by the certified technical supervisors and the protective fire and gas training by certified police and fire instructors. This program is well under way and the organization of the units into specialized crews has started. The theme stressed throughout is that while the units are trained separately, although along parallel lines, they must be ready to aid and supplement the defense activities of the other groups as demanded by war emergency. This fact has been well received and accepted.

Utilities Organized for Civilian Defense

The organization of utilities for civilian defense started with the emergency water program. A State Emergency Water and Sewage Committee was formed and the Chief Engineer of the Bureau of Sanitary Engineering of the Indiana State Board of Health was selected as State Water Coordinator. Certification of key water employees for arm bands and identification cards was authorized. A series of state-wide meetings of water works officials was held starting with a two-day conference at Purdue University. Technical phases of defense preparation were discussed and plans developed for instructing employees locally on technical and protective subjects. The mutual aid system has been thoroughly planned and is well organized and includes all the public water supply plants in the state.

The general utility emergency program was started with a state-wide meeting of officials representing the various utilities. The need for coordination was discussed along with the various problems of identifying insignia. A State Utility Advisory Committee was selected representing electric power, gas, communications, street railways, railroads (steam), water and municipal utilities. This committee assisted in working out the details of authorization of utility employees for identification cards and arm bands and decided upon a system of identification for emergency

vehicles. The State Defense Council strongly urged that all utilities ask their employees to take the ten hour basic OCD course of three hours fire defense A, two hours gas defense A, and the five hours general course. This could supplement technical instructions to be given by the respective companies to their own employees.

The State Defense Council also requested that the State Utility Advisory Committee members canvass their respective fields for suggestions concerning proper procedure for handling the individual utility facilities during an emergency. This information will be issued from time to time in the form of bulletins from the State Defense Council to supplement federal instructions on utility preparation.

The programs discussed so far cover the fields of public works and public utilities and are vital to civilian defense. There is, however, still a considerable pool of engineering knowledge and technical ability yet to be utilized.

Engineering Advisory Committee

To take full advantage of the engineering knowledge available an Engineering Advisory Committee is to be organized in each county to serve as a source of technical advice for the County Civilian Defense Director. Volunteers were secured for these committees by canvassing the rosters of the various engineering societies of the state. The response was excellent as several hundred engineers volunteered. They were classified as to place of residence and branch of engineering practice and this information was sent to the County Civilian Defense Directors who are calling the groups together for organization.

These committees will be a source of technical advice as well as personnel for actual technical supervision in case of an emergency. Technical Bulletins from the State Defense Council will be referred to these committees.

The architects are cooperating in able value in their professional capacity in the classification of structures for air raid protection.

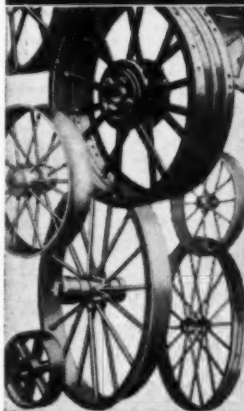
Although this program was organized on a state-wide basis all local engineers not associated with any of the societies were invited to participate.

Contractors Equipment Committee

The organization of a Contractors Equipment Committee in each county was also recommended. These committees will aid the County Civilian De-



★ ★ IF YOU USE ★ ★
WHEELS or AXLES
YOU NEED OUR ENGINEERING EXPERIENCE!



WE have cooperated closely with Industry for more than 50 years—producing millions of dependable, efficient steel wheels and axles; each specifically suited to its task. The knowledge gained through all this experience is available to you now—to help you get the utmost service and satisfaction from your "rolling stock." Write today for complete Illustrated Bulletins.



EWC WHEELS
Electric Wheel Co., Dept. RS, Quincy, Ill.

fense Director in listing contractors' equipment available for use if it is needed to supplement governmental units in an emergency. The State Defense Council contacted contractors organizations and volunteers were secured. These names were given to the County Civilian Defense Directors along with instructions pertaining to the organization of the committee the program and will be of considerable and securing additional volunteers locally.

This, in brief, is the progress of the "Engineering Program" of the Indiana State Defense Council to date. It represents an effort to coordinate all public works and utility agencies, engineering knowledge and technical ability, and contractors' skill and equipment into an efficient and valuable division of Civilian Defense.

These organizations must be expected to "block for" and "back up" protective and relief units of the Citizens Defense Corps for, team work is necessary in our all out effort to win the war.

Engineers work according to specifications and we, as citizens of the United States of America, have a specification for life to maintain, The Bill of Rights.

Help Prevent Blasting Cap Accidents to Children

Accidents to children from playing with blasting caps are a matter of concern to everyone who uses commercial explosives. In most cases blasting caps are carefully locked up,

when not in use, as the law requires or good practice dictates. Unfortunately there are cases of carelessness where the caps are left lying about, dropped near a blasting operation, or in some other method find their way to places where they are accessible to boys and girls.

When they are found, it happens only too often that the children begin to tamper with them. In many cases they hammer or pick at them. In other instances, they throw them into bonfires. Since blasting caps are filled with a powerful explosive, they are often detonated by this treatment, and the explosion throws particles of metal in all directions. Fingers are blown off, hands are often crippled, eyes destroyed. In some cases the children are killed. There have been many instances where boys and girls, as the result of these accidents, have been rendered unfit for useful work in later life.

Although the number of such accidents has been reduced during the past several years, there are still enough of them to make the most thoroughgoing cooperation necessary among all users of explosives. If such accidents can be reduced, they can be eliminated, like other accidents.

The Institute of Makers of Explosives, 103 Park Ave., New York, N. Y., which initiated this campaign and has been extremely active in it, has prepared folders explaining the dangers and also has available posters suitable for plant and other bulletin boards. These are available without charge to all who can use them.

STATE OF INDIANA

Control System for State and County Highway and City Street Units

ROAD REPAIR AND DEMOLITION CREW
EMERGENCY CLEARANCE AND REPAIR
OF ROADS AND STREETS

Governor Henry F. Schricker

Indiana Defense Council

State Highway Commission of Ind.

Indiana State Police

State Fire Marshal Dept.

State Board of Health

Division of Maintenance
Superintendent of Maintenance

County Civilian Defense Director

Commander of Civil Protection for County Area

Engineering Advisory Committee

Contractors Equipment Committee

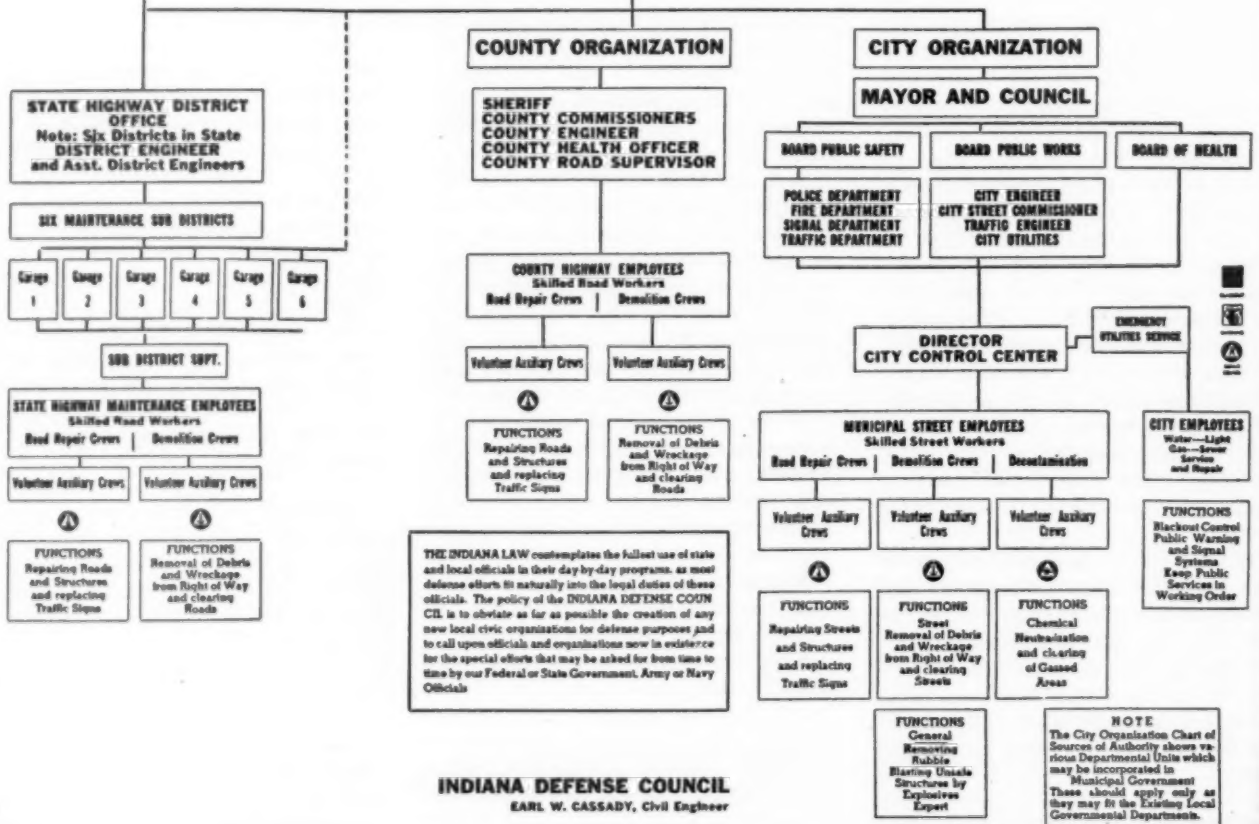


Chart showing control system for state and county highway and city street units

**Care and Repair
in Shop and Field**

CONSERVATION ROAD

CONSTRUCTION EQUIPMENT MAINTENANCE

A SPECIAL SECTION OF ROADS & STREETS

Equipment Maintenance



In Wayne County Shop—Welding damaged snow plow after the heavy storm in January

"KEEP EVERY MACHINE GOING!" —Wayne County's Shop Order

"NO JOB we have is more vital than that of keeping every available piece of maintenance and construction machinery in service. Our goal is 100% work-time from every unit."

These were the opening words of R. H. Steketee, Wayne County maintenance engineer, in telling about his organization's interesting war-time shop program. Wayne County has over 450 major equipment units, and anyone who thinks this is a luxurious amount of machinery should have the task, just for a little while, of trying to stretch it over all the maintenance and service jobs this country has to keep up, parts shortage or no parts shortage.

Since Michigan put township road upkeep under the counties, Wayne County has had 2300 miles of roads, streets and alleys to maintain. Of

these, about 1970 miles are mapped out as a "maintenance system," taking in 400 miles of trunk lines and including some of the most heavily traveled arteries in America. Over 250 miles of county trunks lie within the Detroit city limits. About 800 miles are of concrete, much of which is getting on in years and will need increasing maintenance. 700 miles are secondary lines, mostly of bituminous types.

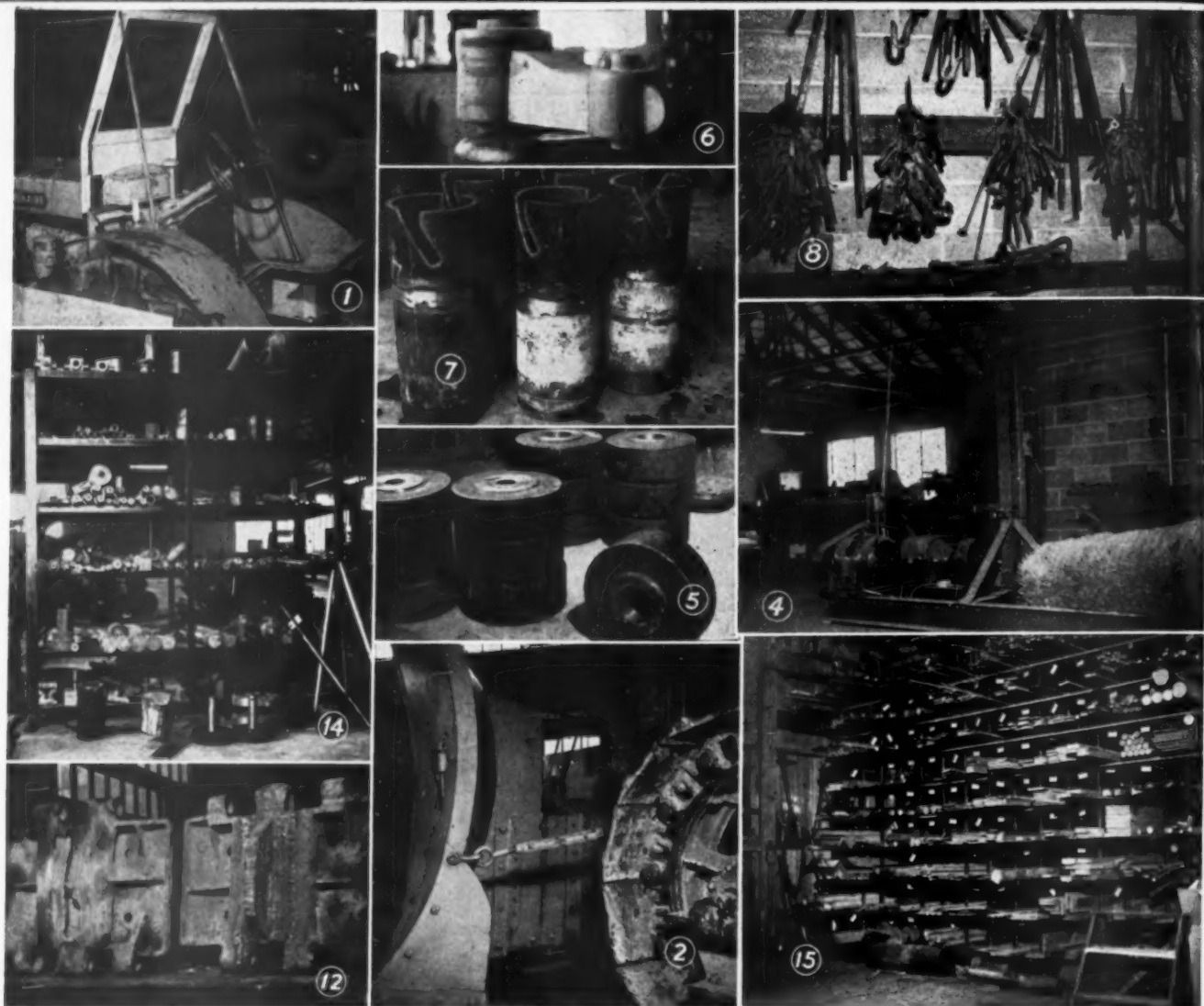
On top of all this, the county is responsible for maintenance of county parks and park drives; state and county grade separations and bridges; subdivision streets, trunk sewers and water mains in unincorporated areas; and a county-leased airport. And in addition last year the county lent equipment to speed completion of Davison Limited Highway, and built gravel roads and streets around military barracks under three contracts.

County Shop Set-Up

Wayne County has five shops, one for each maintenance district. Each has a parts stock room and is equipped for routine servicing and light repairs. Heavy repairs and overhauling, however, are concentrated in large headquarters shop buildings centrally located at Wayne just outside Detroit. These include a storage garage, a modern truck garage with central stock room, and a general repair shop housed in a modernized 165x180-ft. building.

Preventive Maintenance Done to Schedule

Not new anymore, but *news* nevertheless, because of its present vital importance and the faithfulness of its application, is the preventive maintenance routine used by Wayne County. Developed by General Motors sev-



every highway department is finding it necessary to manufacture these days:

(Numbers correspond to the accompanying photo)

A new windshield, entirely home-made, was being built onto a small Silver King snow plough tractor. Glass salvaged from another machine was framed with 1¼-in. hardwood, mounted on an improvised wooden dash-board, and braced with pieces of small angle bar. The wood-working and blacksmithing rooms co-operated on this job, which involved some neat mitred frame corners.

A Wausau snow plough adapted from a truck to a tractor—by means of scrap iron and the welder.

(Not shown) A P & H backfiller, lying around "somewhere" for years, was almost completely rebuilt. All drive shafts were built up with metallizing and machined to size, drive sprockets were restored up with the welder, several completely worn-out track rollers were rebuilt, and numerous structural parts replaced from scrap pieces.

Here is a "honey"—a completely shop-built broom machine for street sweeper brooms. The frame is

made from old structural iron; the power hook-up consists of a discarded countershaft clutch from a shop lathe, a speed-reducer unit from a sand spreader, and the electric motor from a compressor obtained in wrecking a roadside gas station. A plan sketch for this outfit was generously provided by the broom machine manufacturer, which normally would have received an order.

Cast steel snow-plough rollers, for Champion and Ross ploughs; made in a commercial foundry from wood pattern. (One of the simpler jobs, but be sure the metal is plenty tough and hard!)

New arm for a shop drill press, cast locally from the home-made pattern shown.

This is another neat trick! The steel cylinders from the county's pavement core drill, when worn down, are no longer discarded. Instead, the worn tubing is salvaged by welding on a 6 or 7 in. length of new tubing, giving the bead a few turns on the lathe to take off rough spots, and slotting the new end to original design with a torch. The cost is low, metal is saved, re-threading avoided.

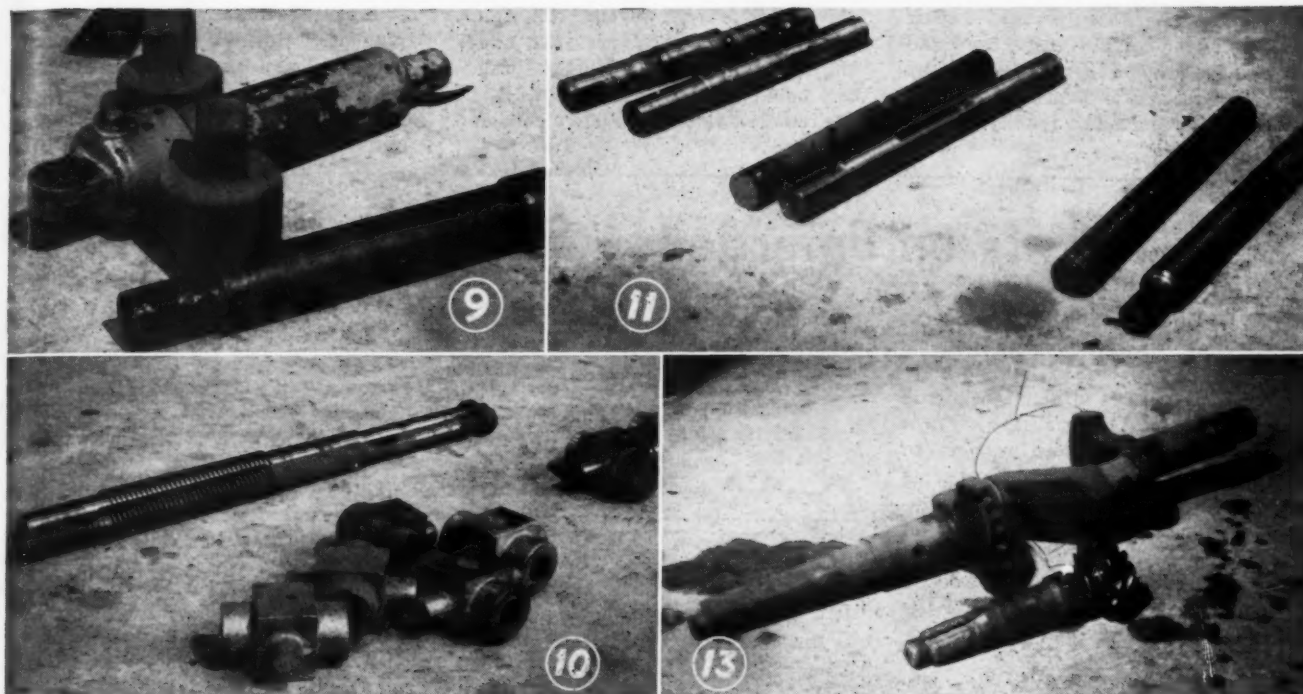
The wall of the blacksmith room is heavily hung with scores of home-made items, of the kind that the average highway shop is "always fresh out of"—clevis pins, turn-buckles, tractor chain rings and a few fancier items. Try and get these items from the factory these days. Scarifier and roter teeth are also made here from stock bars of tool steel.

Replacement parts for a hydraulic hoist unit (for snow ploughs). Lower end casting is foundry-made from shop-built pattern; piston end is given new cup leathers.

Special brass screw nuts and large screws for bascule bridge mechanism are made in the shop (factory supplying them went out of business). A commercial foundry job, plus several machining operations and special threading.

Main drive shafts for an Eagle loader. Three broken shafts were being replaced with home-made articles, involving lathe turning, cutting of keyways on milling machine, and holes made with the drill press.

Trick of the week recently (not pictured) was that of replacing the front



spring of a Caterpillar bulldozer by assembling the longer spring leaves from a 1918 Liberty truck.

Metallizing and Welding

12. Tractor track pads don't come too torn-apart or worn down for salvaging by the Wayne County welders. The accompanying photo shows one pad rebuilt (before machining) by welding a piece of steel to restore the guide flange. No pads are discarded, however "hopeless" their condition.

13. A keyed pinion shaft from a Dodge truck, another conservation-by-welding example. The tapered end of this vanadium alloy piece—replacable only with weeks of delay, if at all—was easily built up and machined to an accurate fit. Shown with it is compressor camshaft with main bearing built up by the welder.

14. A rack-full of welded or metallized replacement parts for many types of machines is kept on hand, giving evidence that the well-known advantages of these two salvaging operations are capitalized to the limit. The general rule is to weld and machine down when fair tolerance will do, and send out for a metallizing job and then machine where greatest accuracy is required.

15. One of Wayne County's two sources of metal for repairing—the metal stock room. The other source is a well guarded scrap pile.

A large bevel driving gear from a Link-Belt crane (not shown) is one of a great many other valuable and

hard-to-get parts repaired or built up with welding this winter. Four broken teeth were replaced by building up with ordinary soft rod. The new metal was turned down on a lathe and the compound-angle teeth cut with a shaper. The latter operation

required construction of a special holding fixture.

In Summary

Wayne County's wartime motto is "Keep 'em all going!"

Its formula—simple in essence, but calling for plenty of skill and good

EQUIPMENT IN WAYNE COUNTY'S GENERAL REPAIR SHOP

(In addition to repairing and servicing equipment in the county's central truck garage and four district garages)

Lathe—44-in. Le Blond heavy duty engine-type.
 Lathe—18-in. American.
 Lathe—18-in. Boyle & Emones.
 Milling machine—Milwaukee No. 3 B.
 Shaper—24-in. American.
 Drill press—Greenerd.
 Drill press—small Etna.
 Radial drill—Niles Bement Pond.
 Radial drill—American.
 Arbor press—make not given.
 Surface grinder—American.
 Surface grinder—Greenfield Tap and Die.
 Surface grinders—two units, makes not given.
 Power hacksaw—(2) Fairbanks (Peerless Machine Co.)
 Pipe threading machine—Oster Mfg. Co.
 Arc welder—(1) portable unit.
 Acetylene welders—(4) portable units.
 Broom making machine—home made unit, after Elgin design.
 Sheet metal benches.
 Woodworking department, with lathe, circle saw, band saw and wood-working machine.
 Pump repair bench.
 Electrical test bench (armature rewinding work sent outside).
 Power lawn mower repair department, including Peerless knife grinder, home-made knife grinder, bench.
 Compressor—Ingersoll-Rand 50 h.p. stationary.
 Blacksmith room with two large forges, large Hazel trip hammer, Rockford drill press, bolt threading machine, pipe bender.

management—is to *prevent* repair jobs by dead-certain inspection and servicing, *salvage* and *preserve* by equally systematic overhauling, and *manufacture* parts not readily obtain-

able under present wartime conditions.

The foregoing activities are under the direction of J. K. Norton, assistant county highway engineer, R. H. Steketee, maintenance engineer, and

Milford N. Brown, general superintendent. Herman Kuhn is general shop foreman and Ed. Oekhla, foreman at the Wayne shop. Leroy C. Smith is county highway engineer.

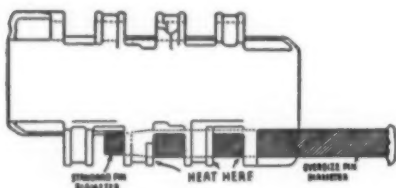
Hints on Emergency Shovel Repairs

HOW to keep machines in operation when replacement parts aren't to be had, and incidentally help conserve vital materials, is given in Thew-Lorain's new "Fix-it Handbook," available on request to the manufacturer. Following are some of its timely suggestions. While directed particularly to owners of Lorain 820-82-81-80-79-70-69 models, many of these hints should be helpful to green shovelmen regardless of the make of shovels in their care.

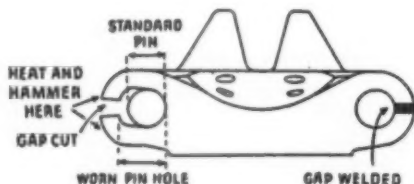
Crawler Treads

Reshaping Tread Pin Holes—Worn or elongated tread pin holes can be reshaped to take oversize or standard pins.

Method 1—Heat the shoe with a blow torch around the pin hole area.



As the temperature increases, drive in a large tapered pin, as shown. Hammer around the outside of heated hole at the same time, forming a round



hole around the pin. Then insert oversize pins.

Method 2—Split the end of the worn and elongated pin hole with a torch. Then insert a standard pin in the hole and apply heat around the outside pin hole area. When desired temperature is reached, hammer wings of opened pin hole to fit tight around standard pin and fill gap with weld to make a complete new hole.

Building Up Tread Teeth—Worn tread teeth can be built up by welding at the points shown. (A drawing will be furnished by manufacturer upon

request so that a template may be made to insure building up teeth to the proper contour and form for good

BUILD UP AT THESE POINTS



service. Be sure to give serial number of your machine.)

Building Up Tread Path—Worn tread paths can be built up by weld-

BUILD UP AT THIS POINT

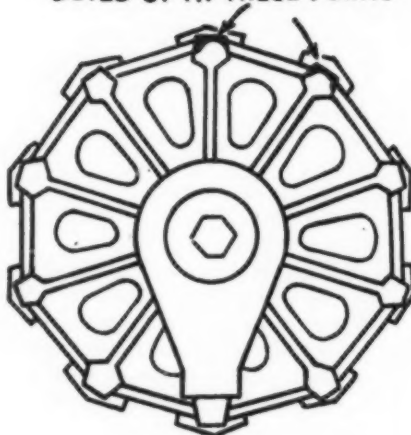


ing at the points shown (template desirable here also).

Drive Rollers

Building Up Driving Lugs—The driving lugs are apt to wear. These

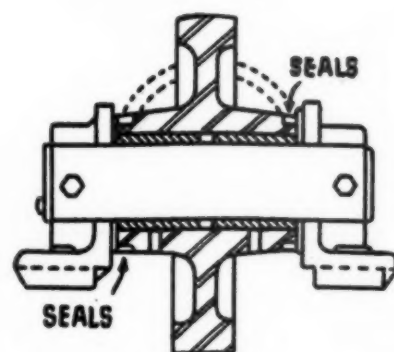
BUILD UP AT THESE POINTS



can be built up by welding at the points shown.

Bushing Seals

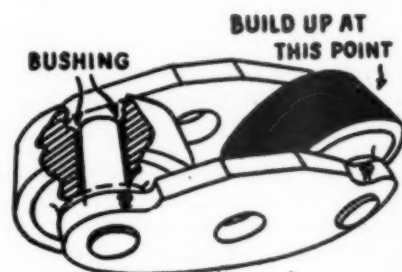
Seals of wear and grease-resistant synthetic rubber are used to protect all bronze bushings of idlers, rollers and sprockets. These seal the grease inside, and keep out mud and water. With present critical shortage of rub-



ber, this type seal may not be obtainable. Felt seals, fitted tight and driven in well, will make a passable substitute.

Turntable Rollers

Building Up Outside Surface—The circumference of the turntable rollers is apt to wear. Worn surfaces can be built up by welding and re-machined

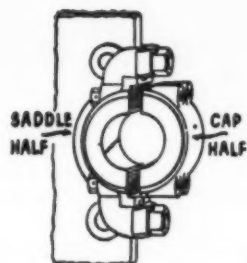


to original diameter and pitch. (Drawings giving necessary details available from factory. Give serial number of your machine.)

Bushings—Because turntable rollers support the weight of turntable and boom loads, bronze bushings only recommended. However, hardened roller bearings will suffice, if available.

Hoist, Swing, Travel and Crowd Shaft Bearings

Bronze bushings (in halves) support the power shafts. These bearings may be reversed or interchanged to prolong their life. In other words, the cap half may be installed in the saddle and the saddle half in the cap. Remove sufficient shims to compensate for the wear and the change of location of halves.

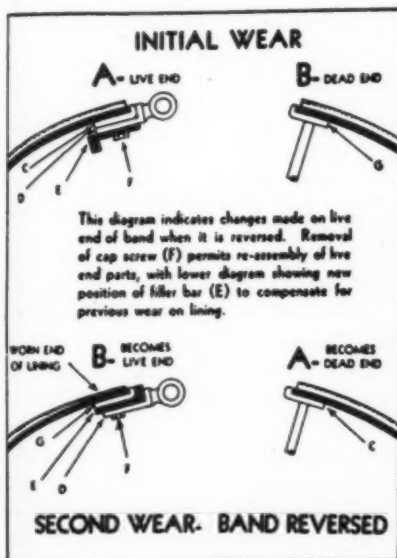


Scrape the bushing or ream it, if possible, to insure the best fit. Be sure the shaft rotates freely after the cap is securely in place.

(This procedure has its limitations—depending upon extent of wear and direction of wear.)

Swing Clutch Linings

Linings are mounted on reversible bands. After initial normal wear, the band may be reversed, end for end,

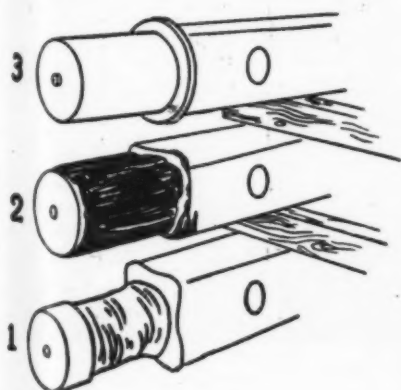


to yield again as much, and often more, additional service by following the procedure illustrated.

Building Up End Axles

These three drawings illustrate the three stages in rebuilding the axles:

1. Lower view shows axle after 12 years of service. Hard service and



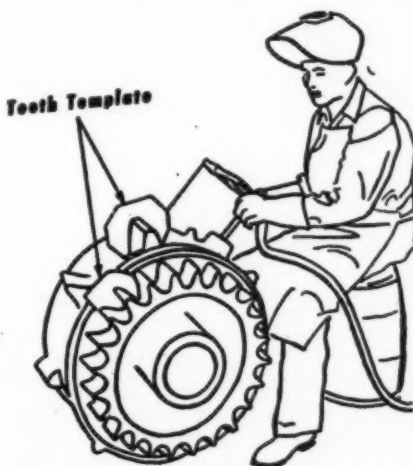
lack of grease have caused the wear shown.

2. The end of the axle in the center has been built up with electric welding. An abundance of material has been added to provide a brand new bearing surface.

3. Top view shows axle turned down on a lathe to provide a standard-size new bearing. New washers have been welded on and the axle has been painted and is the equivalent of a new axle and bearing.

Welding Rod

A good general purpose heavy-coated downhand rod of 60,000 lb. min. strength selected to suit the



welding equipment available is advisable. Bare wire or lightly coated rods are not advisable. Lincoln Fleetweld No. 9 HT, Champion Red Devil, Murex Cresta, Wilson 851 are good downhand rods.

Pre-Heating

It is desirable to warm parts thoroughly before welding to at least above the temperature of boiling water, especially if the shape of the part is irregular or intricate; 400° F. of pre-heating is desirable in many cases where the hardness of the part indicates high or medium high carbon. Relative hardness can usually be determined by filing or chipping.

In all cases where involved shapes occur or thick and thin sections meet, and the atmospheric temperature is below 60° F., very slow cooling is most important. Therefore, warm the piece occasionally while cooling to effect slower cooling.

Bushings

Bronze will become more and more critical as time goes on. Therefore, in many cases, customers will be unable to obtain priority ratings high enough to purchase new finished bronze bushings. As a substitute, grey iron or malleable iron may be

used. (These must be obtained and machined locally.) When this type bushing is used it should be greased generously and frequently, as severe shaft scoring and scratching may result otherwise.

Turn in Old Parts

When entering orders for new repair parts through your distributor, your cooperation is solicited in seeing that the used or worn parts are turned in to the distributor for inspection. In many instances, the distributor may be able to salvage the old part by various reconditioning processes. Perhaps an exchange may be arranged on the worn part, or the scrap price on the worn part may be issued. This is in keeping with the nationwide program to "Turn in the scrap."

Keep your worn parts if they can be reconditioned to give reasonable service.

Which Is the Factory Part?

Which is the old worn-out part whose badly scored surface was built up and restored by "metallizing" and machining? This photo of a pair of



motor grader axle parts comes from the Sauk County highway shop at Baraboo, Wisconsin. The restored part is at the right.

Use Large Sheaves and Drums To Make Rope Last

Experience has established the fact that from the service viewpoint, a very definite relationship exists between the size of the individual outer wires of a wire rope and the size of the sheave or drum about which it operates. Sheaves and drums smaller than 200 times the diameter of the outer wires will cause permanent set in a heavily loaded rope. Good practice requires the use of sheaves and drums with diameters 800 times the diameter of the outer wires in the rope for heavily loaded fast-moving ropes.—From "Valuable Facts About the Use and Care of Wire Rope."

Casting Lugs On Ends Of Wire Rope

WE HAVE adopted the practice of casting a lug of solder onto the ends of many of the wire ropes used in our factory. The only exceptions are some of the hoist ropes, which are ended in a basket-type socket, and some of our slings in which the end of the rope is spliced into the rope body to form an eye or bight.

The soldered lug serves several purposes: First, it eliminates the exposed ends of the wires, which are a source of injury and infection to rig-



Preparing wire rope for casting lugs

gers and others handling the rope. Second it serves as a means for readily attaching hoist ropes to the drums of overhead traveling cranes. Third, where ropes are fastened by clips, the lug on the rope end provides an additional safety feature inasmuch as should slippage of the rope occur the last clip will catch the lug and hold the rope.

Because of its ease of handling, lack of tendency to fly apart, and its resistance to fatigue, preformed rope is being used throughout our plant for crane and hoist ropes and for many of our slings. Since this rope requires no seizing at the ends to hold the strands in position, it lends itself better to the casting of solder lugs on the ends. For this purpose we have made some split molds of steel, similar to the one shown in the sketch. These molds are provided for all the sizes of rope we use. The two sections of each mold are held together by means of two screws

By C. R. HOCHMUTH

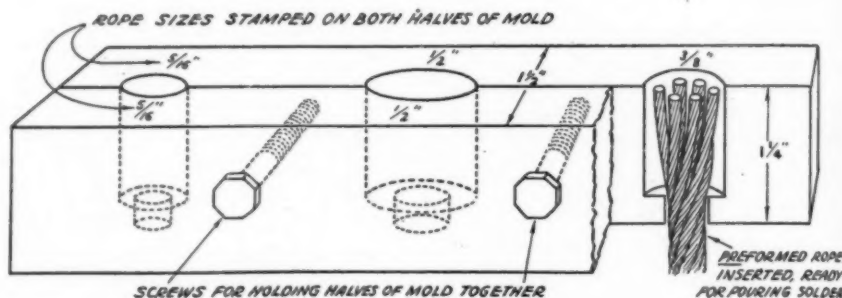
Assistant Works Manager
Kearney & Trecker Corp.

passing through one section of the mold and into the other section. The mold shown in the sketch will accommodate three sizes of rope, each size being stamped on the mold by means of punches.

To prepare the end of the rope, the strands are unlayed for about an

inch, and then are spread apart, after which hard solder is poured into the mold. After the solder cools, the screws holding the mold together are removed, allowing the two mold sections to be separated so the rope with the attached lug of solder can be removed.

To eliminate sharp edges, which might cause scratches or cuts to the hands of those handling the rope, the



Steel split mold for use in casting lugs

inch and the hemp center is cut back the same distance. The unlayed strands are then cleaned of lubricant and grime by dipping them into a half-and-half solution of commercial muriatic acid and water. The rope should not be inserted so deep that the acid will get on the hemp center. The strands are then tinned by dipping them into molten solder. It may be necessary to dip in acid and solder several times before a good tinning job is obtained. By bunching the strands together they are passed through the bottom of the

edges of the lug are filed slightly round.

Where solder lugs are to be applied to ordinary, or non-preformed rope, it is necessary to apply a seizing of soft wire to the rope at a point just below the bottom of the mold, to prevent the strands from raveling. The seizing must be applied before the strands are opened up, and it should be followed by another seizing an inch or so below the first. After the lug is cast, the seizings may be removed.



Wire rope with lugs cast on ends

Cast Iron Motor Block Repair

By JAMES H. DAVIS, Perryton, Texas

Broken cast iron motor blocks—a maintenance headache when parts are scarce—can be fixed easily by arc welding. The huge cracked portion of a G.M.C. motor block was removed and the edges "V'ed" with a diamond point chisel. Next, a piece of $\frac{3}{4}$ -in. metal was cut to fit the water jacket. The repair was completed easily in two hours' time—using a carbon arc with $\frac{1}{8}$ -in. bronze filler rod. A regular cast iron rod can also be used successfully for this type of repair.

When a bronze filler rod is used for the repair of cast iron, the operator should work at a low range of current. For instance, the above job was performed with a 200 ampere welding generator set at 100 amperes. The arc was drawn on the cast iron, allowing it to play over a surface not more than 2 in. square. The bronze was deposited just as soon as the pores of the cast iron were open. This means just as soon as the area begins to turn dark red and assumes a "sweaty" appearance.

After the deposition had started, the arc was kept on the filler rod—not on the cast iron. Sufficient heat passed from the rod to heat up additional areas as I was ready for them. I deposited the rod with a weaving motion over each approximate 2-in. area. Care was taken to make short intermittent welds—peening after every pass. The entire "V" was covered, one 2-in. area at a time, depositing not more than $\frac{1}{4}$ -in. to $\frac{3}{8}$ -in. depth of bronze in each layer. If greater thickness had been desired, I would have deposited layers, wire brushing carefully between each.

Successful arc welding of cast iron with cast iron rod depends largely upon the good judgment and patience of the operator. An operator who has had experience with other methods, and who has closed his mind against the possibilities of the arc, is less likely to be successful than the man who is willing to learn.

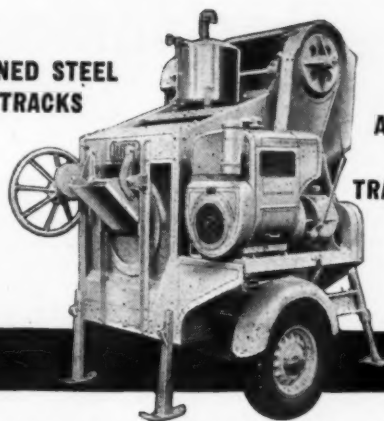
Most ordinary cast iron welding jobs can be handled by arc welding without pre-heating. The joint or crack in the casting should be chipped out, scarfed, or ground in a "V" or double "V"—depending upon the thickness and shape of the cross section of the parts to be welded. A single "V" should extend to within $\frac{1}{16}$ in. of the root, and in the case of welding together two parts, they should be spaced $\frac{1}{16}$ in. apart. The

double "V", used on castings thicker than $\frac{1}{2}$ in. should also be prepared with $\frac{1}{16}$ in. root face and $\frac{1}{16}$ in. root opening. The included angle of the "V" should be about 90° . When only a crack, less than $\frac{3}{16}$ in. thick, is to be welded, it is usually necessary to scarf the crack only slightly more than one-half the depth. The same rule applies to carbon arc welding with a bronze rod.

Never rush a cast iron welding job. Never hold the arc on the casting continuously for sufficient time to bring the iron adjacent to the weld up to a cherry red color. Always break the arc BEFORE the cherry red color is reached. This is a good rule to follow to avoid accumulation of too much heat in the casting which might result in excessive tensional strain when cooling takes place.

Lay short beads, one inch to three inches long, depending upon the nature of the work, and let each bead cool until you can lay your hand on it before starting another one. Place the first bead at one end of the crack or joint, the next one at the opposite end, the next one in the middle, etc.

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This procedure will help to distribute or equalize stresses.

[The above article is from *Hobart Arc Welding News*.]

Making Your Own Large-Diameter Bolts

Almost every highway department or contractor repairman needs to replace large bolts now and then. When bolts cannot be obtained for love or money or priority, remember that bolts larger than $1\frac{1}{2}$ -in. in diameter can usually be made economically by arc-welding.

At least this is the experience of Mr. Earl Lahr, of Johnstown, Pa. Writing in *Hobart Arc Welding News* he recommends that for large welded bolts, standard round bars should be sawed to length and threaded for the bolt body. Heads are then welded on to the bodies with regular mild steel electrodes in single passes. Shearing strength on weld line is greater than tensile strength of bolts—this is necessary since these large bolts are subjected frequently to severe sledging.

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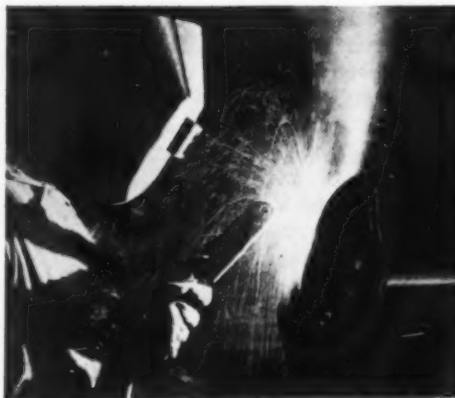
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Reclaiming Worn Sheaves

By F. L. SPANGLER, M.E.

SINCE steel or iron sheaves are not easily obtained these days, it behooves everyone to make all sheaves or drums last as long as possible. Frequently old sheaves can be reclaimed and kept in use by building up the worn grooves. A common method for building up worn sheave grooves is to deposit metal in the worn grooves by either arc welding or by metal-spraying. Where the sheave groove is badly worn, flat spots or places of uneven wear can be built up by welding and then the welding arc, or the metal-spraying gun, used to apply the final layer over the entire wearing surface.

The use of too soft a material, such as cast iron, is often the cause of undue wear of sheaves. Originally soft sheave grooves built up with a hard metal have given as much as five times the original wear. Hence, the reclaimed sheave might be a decided improvement over the new. Here, too is proof that harder



Building up a worn sheave groove with the metallic welding arc

sheaves, such as manganese, might well be economical in the long run. A long-wearing sheave saves more steel than is at once apparent, for in addition to saving precious sheave metal, it is much easier on the rope than is a sheave of softer material.

However, wire rope in itself can be

a needlessly destructive element to sheaves. Ropes which tend to twist squirm, or rotate as they pass over sheaves cause far more rapid sheave-groove wear than where such twisting is absent. Because of the elimination of torsional stresses in preformed rope, this type of rope does not tend to twist or rotate in sheave grooves and thus reduces groove wear as well as rope wear. It has long been recognized that the use of hard sheaves, with preformed wire rope, will effect pronounced savings in replacement or reclamation.

Approved methods of building up worn sheave grooves by arc welding and by metal-spraying, with advantages and disadvantages of each process, can be briefly stated as follows:

Arc Welding

How to Apply—Use an electrode that is suitable for depositing on the particular metal of which the sheave is made, and where practical select an electrode that will give a hard surface without heat treatment. With a steel sheave use a manganese-steel electrode or a self-hardening electrode, deposited in a layer not more than $\frac{1}{8}$ inch thick. Where the wear is greater, fill in with a carbon-steel electrode before depositing the final layer of hard metal.

Apply the metal by the skip weld method to minimize distortion.

Finally, true up the groove.

Advantages—Can be applied to sheaves having even or uneven wear. Can be performed without removing the sheave, if necessary. Many users of wire rope are equipped to build up sheaves by welding.

Deposit is very dense, contributing to long wear.

Disadvantages—Arc weld deposits on cast iron sheaves will require heat treatment if hardness is desired. This is not true of steel sheaves.

The heat of welding tends to distort the sheave.

Metal-Spraying

How to Apply—If uneven wear is present, build up to uniform contour by welding or by truing up on lathe.

Prepare surface by blasting with sharp steel grit. After blasting keep

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IT ON!
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THEN
RINSE
IT OFF!**

surface clean. Do not allow hands to come into contact with the surface.

Apply metal by rotating sheave in lathe with spray-gun attached to tool post. Use 1.2 carbon wire.

Advantages—Can be used to give hard surface to cast iron sheaves as well as steel sheaves.

Does not distort sheave if applied as directed above.

Requires no truing up of sheave groove after application.

Deposited metal is capable of absorbing rope lubricant, thereby retaining oil film on surface.

Wearability of hard deposit increases life of sheave and rope.

Disadvantages—Very few users of wire rope have the equipment for metal-spraying and must rely on job metal-spray shops to do the work.

Since metal-spray is applied in a uniform layer, it is not suitable for building up worn spots or corrugations.

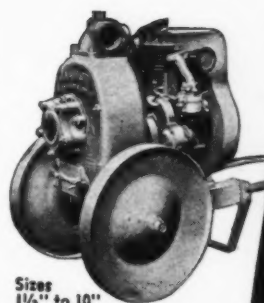
Associated Equipment Dealers Have Record Attendance

Breaking all records for turn-out, more than 850 registrants were tallied at the "Victory Seminar" of the Associated Equipment Distributors in Chicago, January 10-14. This reflects the Association's healthy condition and strong desire of members to adapt their business to wartime needs and conditions.

Ed P. Phillips of Richmond, Virginia, was elected president; G. W. Van Keppel, Kansas City, Mo., first vice-president; H. O. Penn, New York, second vice-president; Frank B. McBath, Portland, Ore., third vice-president; and W. W. Bucher, New York, treasurer. C. F. Winchester was re-elected executive secretary.

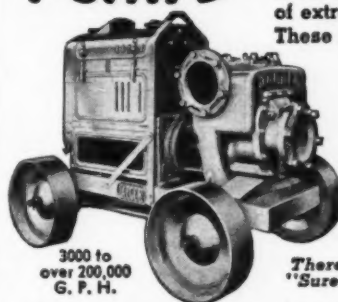
New regional directors are: Wm. Danner, Boston, Mass.; H. O. Penn, New York, N. Y.; James C. Alban, Baltimore, Md.; Ed. P. Phillips, Richmond, Va.; A. E. Hahn, Atlanta, Georgia; Chas. O. Finn, Cincinnati, Ohio; R. S. Patten, Chicago, Ill.; R. S. Rosholt, Minneapolis, Minn.; G. W. Van Keppel, Kansas City, Mo.; Geo. A. Cooper, San Antonio, Texas; John A. Beynon, Los Angeles, Calif.; Frank McBath, Portland, Ore.

The Board of Governors will be: Chairman, T. W. Harron, San Francisco, Calif.; member, Ed. R. Bacon, San Francisco, Calif.; member, C. G. Borchert, St. Paul, Minn.; member, Wm. H. Ziegler, Minneapolis, Minn.; member, H. W. Fletcher, New Orleans, La.



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Better Materials to lick TOUGH Jobs. Whatever your service we will guarantee results. Send dimensions and tell us what you need.

GATKE CORPORATION, 234 N. LaSalle St., Chicago

EXPLOSIVES

(Continued from page 56)

G. Blasting Frozen Gravel Banks

In gravel banks a 1-pound charge placed approximately 6 feet from the face will loosen the gravel in that frozen area.

During intermittent thawing and freezing periods cracks in frozen gravel banks should be watched closely; they are the forewarning of slides or cave-ins.

804. Making Primers

The primer is the stick in which the cap is placed. Punch a hole from the center of the end of the cartridge in a slanting direction so that it will come out at the side 2 or 3 inches from the end. Insert the ends of the double-over wires of the electric blasting cap and loop these around the cartridge. Then punch another hole in the top a little to one side of the first and straight down. Insert the capsule in this last hole as far as possible and take up the slack on the wires. The wires now do not cross each other at any point. The capsule or detonator is lying nearly along the center line of the cartridge and the primer hangs vertically, so that it is possible to load it in a vertical bore hold without its lodging against the sides. See figure 805, page 57.

A second method preferred by most explosive foremen is: Punch a hole in the end of the cartridge approximately $\frac{1}{2}$ inch deeper than the length of the blasting cap. About 3 inches from the end make a hole through the cartridge. Pass the cap through this hole and imbed in the hole in the end of the cartridge. Pull the wires taut. This method is quick and will not chafe or bend the wiring.

The wires of electric blasting caps should never be fastened around high explosive cartridges by half-hitching them, as a strong pull is apt to break the wires or cut the insulation. See figure 805.

All of the recommended methods of priming are based upon two principles; first, placing the detonator so that its greatest force will be exerted upon the charge of explosive, not upon the stemming or the walls of the bore hole; and second, protecting the cap from accidental detonation and the wires from injury. Paintaking application of these principles will reduce premature shots, delayed shots, and misfires, and secure maximum results from the explosive.

805. Loading

A. Definitions of Loading, Tamping, and Stemming

Loading is the placing of a charge

of explosive in a bore hole or tunnel, or placing a mudcap charge, and adding the stemming material.

As used in this handbook the word "tamping" means the act of closing a bore hole or covering up a shot and the word "stemming" refers to the material used.

B. Care in Loading

In order to insure complete detonation of the explosive, it is important that it be carefully loaded and confined in a clean bore hole. The blaster should avoid smearing the walls of the bore hole with loose explosives. Contamination of the explosive with rock dust, earth, or other foreign matter tends to lower its propagation sensitivity.

A careful examination of a sprung hole should be made before loading to be sure that it is open, and especially to see that it has cooled off from the heat of the springing shot. If this latter precaution is neglected, hot rock in contact with the charge may cause a premature explosion resulting in serious accident. Special care should be taken in sprung holes to secure compact loading and to eliminate air spaces.

Try the hole with the tamping stick to see that it is open and sufficiently deep and large. The required number of cartridges should be slipped in one at a time and pressed into place with the tamping stick. The primer should be placed near the last of the charge with the cap pointing toward the bulk of the charge.

Do not exert too much pressure in loading the explosive charge or attempt to ram the cartridges into place. This may result in a premature explosion. Utmost care should be used in loading the primer cartridge. Care should be taken to avoid leaving air spaces around the charge.

C. Disposal of Wrappers

Explosive wrappers should not be taken off the cartridge. In loading, the cartridge wrappers should be slit so that the cartridge will expand, filling the space prepared for the load and not allow large air pockets to occur. If, for any reason, cartridge shells, bags, liners, or packing material cannot be mixed with the explosive, they should be carefully collected and burned in a suitable location where no fire hazard exists. Since these wrappers are poisonous and stock will lick them for the salty taste, under no conditions should they be left where stock can reach them.

D. Stemming and Tamping

The first few inches of stemming should be pressed only lightly to avoid jarring the cap. The rest of the stemming should be packed in firmly, using the wooden tamping stick. Take care to avoid losing the end of the electric blasting cap wires in the hole.

Stemming should be free from stone and grit. For large holes where the weight of the stemming gives the confinement, dry free-running sand is good. For other work, a moist easily packed sand, clay, or loam is best. Stemming is probably the most dangerous single feature connected with the use of explosives in setting fires. Be sure the stemming is noncombustible.

When a large amount of water covers a charge of high explosives in a vertical or downward pointing hole, further stemming is sometimes omitted as the water gives fairly good confinement.

Good confinement is often difficult in loose or shattered soil and rock under which conditions fire-setting is possible. Some of the charge, if mixed with soil particles or separated from the main charge along cracks, may burn instead of detonating and set fire to surrounding material.

Where it is impossible to make a clean bore hole and firmly pack the explosive, special precautions should be taken to remove combustible matter from the danger zone before making the blast.

Good tamping is one of the prime essentials of successful blasting. Never load a hole too near the top; allow room for stemming.

(To be continued)

1942 Shipment of Fabricated Structural Steel

The December bookings of fabricated structural steel amounted to 67,600 tons, as compared to 146,379 tons for the corresponding month of last year, according to reports received by the American Institute of Steel Construction. The yearly total of 1,762,453 tons was twenty-three percent less than the 2,296,954 tons booked in 1941 and about ten percent more than the year 1936.

December shipments of 145,280 tons showed an increase over November. Total shipments for the year were 2,039,966 tons compared with 2,251,089 for 1941. The backlog tonnage for future fabrication on December 31st was 523,532 tons as compared with 626,026 tons at the same time a year previous.

Indiana Roads Rebuilt Since 1937 Withstand January High Water

Due to extensive improvement work done on Indiana state highways following the 1937 record flood, traffic suffered little inconvenience from the high waters along the Ohio River during January.

While flood conditions did not approach those of 1937 and were confined almost entirely to the Ohio River, the improvements eliminated any need for closing several roads which were formerly affected by even minor floods. Included in this program was the reconstruction of Road 50 from Aurora to Lawrenceburg and on to the Indiana-Ohio state line, the construction of Road 107 at Madison, construction of bridges at New Albany, the relocation of Road 62 at Leavenworth, the elimination of low places in Road 69 south of Mt. Vernon, and the relocation of U. S. 31 between Columbus and Seymour together with the work done on the old route between these points.

Also numerous bridges have been built in other parts of the State to provide increased flood-flow capacity and roadway height.—S. C. Hadden, chairman, Indiana State Highway Commission.

No Individual Names or Titles on Highway Signs

Michigan State Highway Commissioner Lloyd B. Reid has ordered the highway maintenance division to remove all individual names and titles from state highway signs.

"The policy of the department henceforth will be that no individual names or titles shall appear on any signs or plaque, unless such names are an integral part of the designation required by law," Reid said. "If I want the public to see my name, I'll pay for it myself."

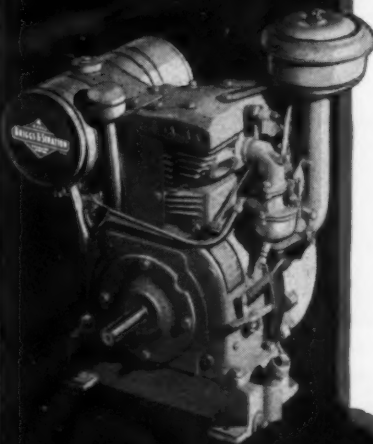
"While the policy of using individual names on signs has been in effect in the state highway department for many years and in other state departments, too, it has always seemed to me a questionable use of public funds and property. I am glad the highway department is the first to abolish it."

The ruling applies to road signs of all descriptions, highway park areas, and signs which may appear on or in connection with highway garages and other structures.

To keep expenses at a minimum, Reid said the change should be made at the regular time of reconditioning and repainting. His name is not on any highway sign at present.

"Reel" action at "X"

"Movies" are up front, too, for periods of relaxation. Keeping these "Reels" rolling, is one of our assignments — for the projectors are operated with lighting equipment powered by Briggs & Stratton gasoline motors. This is but one of scores of "special" applications, in addition to many major ways by which Briggs & Stratton motors are serving our armed forces.



OWNERS of 4 cycle air-cooled Briggs & Stratton motors are fortunate. They are not only assured of dependable power during the present emergency, but they know that these sturdy gasoline motors embody built-in features and quality that insure constant delivery of capacity power year after year. Now, when all equipment is being operated "around the clock", it is most important to keep your Briggs & Stratton motor in tip-top condition. It will pay in extra performance and even longer life.

A book containing Operating Instructions, Adjustment and Repair Information is available on request. When writing, be sure to mention the model letter of your motor.

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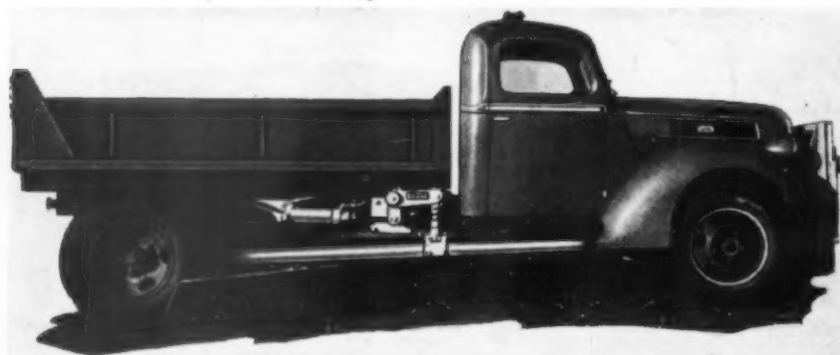


New Equipment and Materials

New Truck Patrol

A new truck patrol having many uses, including grading, ditching, shoulder work, cutting sod and shaving light snow and ice, has been added

manufacturers and operators demand detergent type oils which are non-corrosive to alloy bearings and which eliminate, as far as possible, ring sticking and engine deposits. They are also recommended for gasoline



27 Root Model, 55 Truck Patrol

to the line of the Root Spring Scraper Co., Kalamazoo, Michigan. This model can be installed on any truck with a wheelbase of 185 in. or more. The blade can be set and operated at any angle. Power for the truck patrol is furnished by a simple fan-driven hydraulic pump designed for long service. A power take-off pump can be furnished.

engines in commercial equipment where service is extremely heavy to overcome ring sticking, lacquer formation, and bearing corrosion. Gulf Dieselube H.D. oils are being sold to the government and to commercial consuming accounts operating tractors, busses and motorized industrial equipment. They are lubricating the motors and transmissions of tanks produced by several leading manufacturers.

New Gulf Dieselube for Heavy-Duty Trucks and Tanks

Gulf Oil Corporation has just announced a new brand of lubricating oils which it calls Gulf Dieselube H.D. (Heavy Duty). These oils are made to meet U. S. Army specifications for internal combustion engines for ground equipment such as trucks, tanks and jeeps. They also have been approved by the leading manufacturers of Diesel engines for tractors and trucks. Severe heavy-duty Diesel engine tests conducted by Gulf Research & Development Company, the research subsidiary of Gulf Oil Corporation which developed these oils in cooperation with the Lubricating Department, show them to be remarkable in engine cleanliness and lack of ring sticking. They are detergent oils of the highest quality for use in bus, truck, tractor, marine and industrial installations, as well as other Diesel engines for which

New Tire for Earthmoving Equipment

An earthmover and excavating tire, stated to possess to a new degree of durability and strength, and to provide 98 per cent more resistance to body breaks, has been announced by The Firestone Tire & Rubber Co., Akron, O., and is identified as the Firestone Rayon Multi-Ply Tire.

Firestone engineers point out that the new tire was developed for the three-fold purpose of increasing tire life, conserving rubber and speeding up earthmoving and excavating operations. This was achieved through a number of new design features all of which contribute to greater strength of the tire body. Notwithstanding this increased

strength, the tire maintains a full degree of flexibility, a characteristic which is necessary to efficient operation. From a conservation standpoint the Firestone Rayon Multi-Ply Tire is especially noteworthy. Because of the resistance of this new construction to body failures, the full potential of tread life is utilized.

New Rig for Cleaning Highway Ditches

After more than a year of testing, the Willamette Hyster Co., Portland, Ore., has placed in production the Hystevator ditcher, which is claimed to greatly expedite the clearing of highway drainage ditches. In addition to its principal use for cleaning and trimming highway ditches the Hystevator is also used for loading oil rock from maintenance stock piles loading barreled oil, removing boulders from ditches, loading boulders for rip-rap work, and for loading miscellaneous material or equipment into dump trucks or flat bed trucks. It can be used on any standard make of truck and some of its more interesting features are that it leaves a ditch of proper contour, digs as it loads, no separate power plant or power takeoff is needed, does not interfere with dumping, does not cut down truck capacity, is quickly installed or removed, does not impede




Cleaning highway ditches with the Hystevator

traffic, does not straddle ditch so can work against cut banks, and the truck remains on the highway shoulder out of danger of getting stuck.



BREAK THROUGH

leads to success—*breakdown*, to defeat. To avoid breakdown of *CONSTRUCTION* operating schedules use . . .



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gear oils and greases. These specialized lubricants give the wear protection that keeps equipment standing up to heaviest schedules and hard drive of continuous operation.

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ROADS AND STREETS, February, 1943



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INDUSTRIAL FRICTION MATERIALS

FOR SHOVELS • CRANES • HOISTS • TRACTORS & EARTH MOVERS

CORONACH

*"Of those immortal dead who live again
In minds made better by their presence."*

EDWARD J. SCHROETER, president and general manager of the Huber Manufacturing Co., died January 1. He was stricken with coronary thrombosis and passed away suddenly. Mr. Schoeter became president of The Huber Manufacturing Co. in 1940 after his father's death. At that time he was president and general manager of the Teachout Company in Cleveland. He resigned his position there to take up his new post.



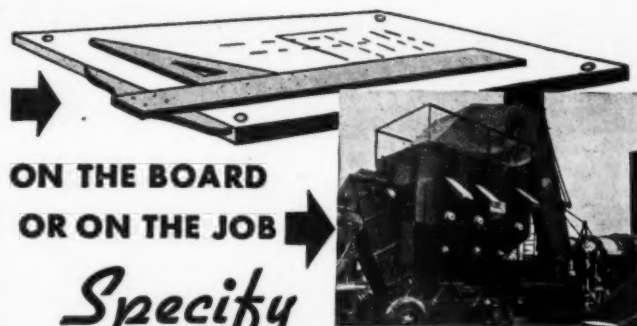
E. J. Schroeter

Mr. Schroeter was born in Marion, Ohio, on August 8, 1891. He was graduated from Cornell University in 1914 with a mechanical engineering degree. Following his graduation he returned to Marion and spent two years with The Marion Steam Shovel Co., learning the rudiments of machine care, assembly and production control. He became a part of the original organization which launched the Jordan Motor Car Co. of Cleveland, at first handling material supply, routing and production, and later serving as assistant sales manager. In 1923 he organized the Macoustic Engineering Co. of Cleveland, a firm which pioneered in the field of sound control in churches, auditoriums, offices and various other types of large interiors. In 1933 the concern was sold to the National Gypsum Co. of Buffalo. Mr. Schoeter was elected to head a reorganization program for the Teachout Company of Cleveland, a large millwork and lumber concern which had been considerably impaired during the depression years. At the time he took over the reorganization the company was operating under the national recovery act. Within a year under his direction the company was doing a thriving business in northern Ohio and at Buffalo, where a branch was set up. Mr. Schroeter had served on the board of directors at the Western Foundry Co. of Chicago and at one time was a trustee of the Cleveland Lumber Institute and on the advisory committee for the construction industry of the Cleveland Chamber of Commerce.

COL. HAROLD W. HUDSON, 67, who was chief construction engineer for the Triborough and Hell Gate bridges in New York City, died January 15 in New York City.

A native of Pittsburgh, Colonel Hudson was a civil engineering graduate of the University of Minnesota, and engaged for several years in railroad location surveys and construction in Colorado and other parts of the West.

He joined the New Jersey State Highway Department in construction of the Pulaski Skyway and Express Highway extending westward from the Holland Tunnel in Jersey City, and when this highway was opened to traffic in 1932, Col. Hudson became assistant state highway engineer, remaining in that capacity until 1934, when he joined Madigan & Hyland to direct construction of the Triborough bridge and connections in New York City.



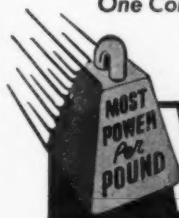
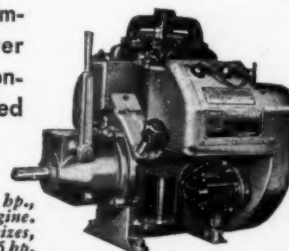
Specify

WISCONSIN Air-Cooled Engines

In the development of new equipment, as well as in the efficient utilization of existing machines . . . the power factor is more important today than ever before. That's why Wisconsin Heavy-Duty Air-Cooled Engines rate Number

One Consideration.

Model VE-4, 22 hp.,
4 cyl., V-type Engine.
Other types and sizes,
1 and 4 cyl., 1 to 35 hp.



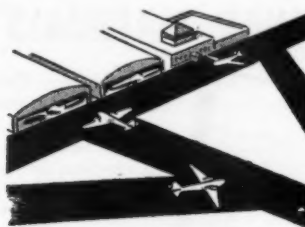
WISCONSIN MOTOR

Corporation

MILWAUKEE, WISCONSIN, U. S. A.

World's Largest Builders of Heavy-Duty Air-Cooled Engines.

ASPHALT for AIRPORT RUNWAYS



Adequate landing fields are urgently needed. Safe, all-weather Asphalt runways can be laid quickly. In most instances local material can be used, which further speeds up the work, and reduces the cost of Asphalt construction.

Airports built now for training and other war measures will also be an asset to your community after they are no longer needed for war.

Wherever Standard Oil Asphalt products are sold, there is an Asphalt Representative who can give you full information about these and other uses of Asphalt. Write . . .

STANDARD OIL COMPANY (Indiana)

910 SOUTH MICHIGAN AVENUE, CHICAGO

With the Manufacturers



New shop and office building of Chicago Construction Equipment Co.

CCECo Have New Home
Chicago Construction Equipment Co., one of the fastest growing Equipment Distributors in the Middle West, have just completed the consolidating

program they have had under way for the past several months. Due to urgent war contracts on construction and airport jobs, this young organization deemed it practical and necessary to

consolidate their sales offices with their plant. At the same time, steps have been taken to properly equip each department with new ideas, streamlined for modern service. The shop itself contains 7200 sq. ft. of floor space with hip-type roof, high enough to handle cranes of one to two yards capacity. Two overhead track cranes do the lifting job. Twenty-one experienced men, each a specialist in his own field, constitute the shop force. If the work needs machining or a job with skilled mechanics to do either a large or small job quickly, they can do it. The Parts Department covers an area of 2250 sq. ft. Modern parts bins and a perpetual inventory constitute an every-ready parts supply. New tube-type racks for air tools have been installed. Modern drive-on type receiving and shipping platforms have been installed for both track and rail shipments. The air-conditioned offices are soundproofed and completely modern.



'ANTHONY'
HYDRAULIC
HOISTS AND BODIES

★ ★ **Award**

**"FOR OUTSTANDING PRODUCTION
OF WAR MATERIALS"**



The Anthony Co. and its Employees are proud of this accomplishment . . . It is a fitting climax to our 25 years of conscientious service to the Hoist and Body industry. It is an inspiration to better our record in 1943 and for years to come.



NOW IN OUR 25th ANNIVERSARY YEAR

ANTHONY COMPANY, INC.
STREATOR * * * ILLINOIS

Bucyrus-Erie Awarded Second Army-Navy "E"

The Army-Navy "E" award was presented to the Erie Works of Bucyrus-Erie Co. on January 16. Previously, the company's South Milwaukee plant had received the same distinguished honor for production achievement. Col. John S. Seybold, Chief of the Army Procurement Branch, Supply Division, Office of the Chief of Engineers, in presenting the "E" banner emphasized the importance of construction equipment in the conduct of this highly mechanized war. W. L. Little, Manager of the Erie Works, accepted the award on behalf of the company. Bucyrus-Erie's regular dirt-moving and material handling equipment is used in a wide variety of activities directly concerned with the war.

Hewitt Appointed Vice-President

James R. Hewitt has been appointed vice-president of the American Manganese Steel Division of the American Brake Shoe and Foundry Co.

Charles T. Ruhf Elected President of Mack Trucks, Inc.

Election of Louis G. Bissell as chairman of the board has been announced by Mack Trucks, Inc. Mr. Bissell, a member of the law firm of Chadbourne Wallace, Park and Whiteside, has served the company for many years as a director and counsel. Also announced was the election of Charles T. Ruhf as president of Mack Manufacturing Corp. and executive vice-president of the parent company, Mack Trucks, Inc. Mr. Ruhf was formerly operating vice-president in charge of factories and has been with the company since 1912. In 1920 he was appointed assistant to the factory manager of the Allentown plant in which position he served until he was appointed factory manager in 1937. In 1938 he was made operating vice-president of Mack Manufacturing Corporation and Mack Trucks, Inc., managing the three Mack factories at Allentown, Pa., Plainfield, N. J., and New Brunswick, N. J.

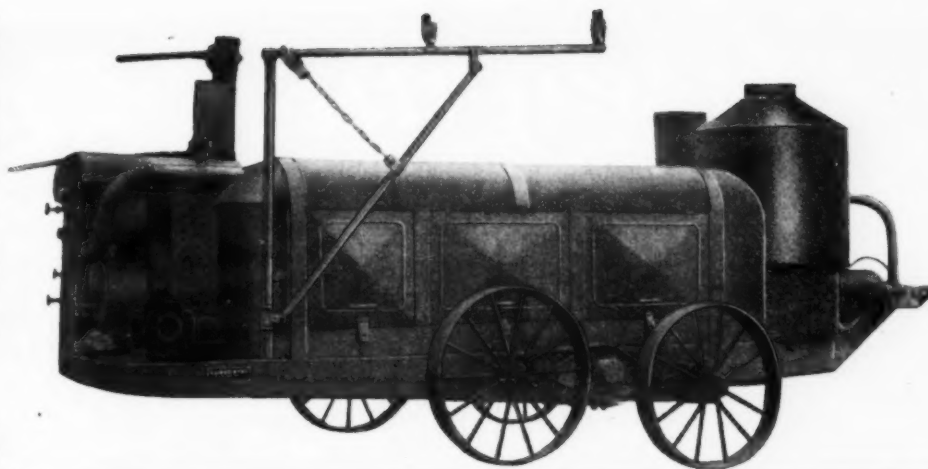
GRACE RAPID FIRE

Circulating heater for tank cars of asphalt. With steam thawing equipment. Increased flue and burner capacity gives even greater speed in heating.

New semi-trailer mounting with tandem wheels prevents whipping or weaving at any trailing speed. Steel tires now furnished easily converted to pneumatics when available. Pumps located for easy access when servicing.

WRITE FOR LITERATURE
MADE BY

W.E. Grace Mfg. Co. Dallas Texas



Irving Subway Grating Co. Awarded "E"

The Irving Subway Grating Co., Long Island City, N. Y., has been awarded the Army-Navy "E" for high achievement in the production of portable airfield mats.

Allis-Chalmers Tractor Plant Earns "E" Award

The Army-Navy "E" for excellence in production achievement has been awarded to the Springfield, Ill., plant of the Allis-Chalmers Manufacturing Co. It is the first such award for tractor production. In presenting the banner, Colonel John S. Seybold, Chief of Procurement Section, Supply Division Office, Washington, D. C., emphasized the importance of tractors in today's mechanized war. Don Schweitzer, Springfield works manager, accepted the award. In an impressive ceremony Lt. Commander Walter J. Eden, U. S. N., presented the Army-Navy "E" pins to representative employees. Walter Geist, Allis-Chalmers president, gave the welcoming address. W. A. Roberts, manager of the company's Tractor Division, was master of ceremonies. Honored guests included Governor



Left to right: Ray Downey, employee representative, Colonel John S. Seybold, U. S. Army, Don Schweitzer, Springfield Works Manager and W. A. Roberts, Manager of Allis-Chalmers Tractor Division

Dwight H. Green of Illinois, who spoke. Since the start of the present emergency almost the entire production of Allis-Chalmers 2-Cycle Diesel

tractors has been used for building war plants, air fields, Army and Navy bases and for service with the U. S. and Allied armed forces.

SILVER KING HIGHWAY MOWER



Watch out for those minor damages that might put your highway mower out of action for the duration. A little extra care prevents extra wear and repair!

If you own a Silver King, you'll see, more than ever, what it means to have a mowing unit ENGINEERED for the job. If you want replacement parts now to insure tip-top "good-as-new" performance tomorrow, write. We will be glad to serve you.

MANUFACTURED BY
THE FATE-ROOT-HEATH CO.
PLYMOUTH, OHIO

$\frac{1}{4}$
Cu. Yd.



8'
Lift

FRONT END SHOVELS

for Industrial Tractors

Write for Catalog

Elkhart White Mfg. Co. Indiana

Clearing House

P&H 600 No. 3053 Shovel, 1 yd., 40' Boom. Good shape, load now, FOB Mo., \$6,000.00.

Thew Lorain 1 1/4 wide Dipper, 32T. Wt. FOB KC. \$4,000.00. Old but good, all gears 90%. Fine for coal or rock.

Byers rebuilt Bearcat Jr., high lift, late model Shovel, air tired factory trailer. FOB KC., \$4,500.00. Ready to go.

We have practically everything you need.

Call Wire Write

KENNEY MCHY. CO.

2136 Jefferson, Kansas City, Mo.

EXCEPTIONAL BARGAINS IMMEDIATE SHIPMENT

FOR SALE:

44C Barber-Greene Ditcher.
10S Koehring Mixer on 2 Pneumatic Tires.

4" Rex Self Priming Pump—Gasoline Power.

FOR RENT:

522 Barber-Greene Pneumatic Tired Bucket Loader—Gasoline Power.

PAUL L. MATCHETTE COMPANY

Exclusive Distributors for Barber-Greene Co.
Missouri — Kansas — Oklahoma
20 West 9th Street, Kansas City, Mo.

TRANSITS and LEVELS



**New or Rebuilt
Sale or Rent**

Headquarters for
REPAIRS — any make.
Factory Service. We will
also buy your old in-
struments or take them in trade.

A complete line of Engineering
Instruments and Equipment for Field
or Office. Write for Bulletin RS 82.

WARREN-KNIGHT CO.

Manufacturers of Sterling Transits and Levels
136 N. 12th St. Philadelphia, Penna.

FOR SALE

Rotary Dryer—3 1/2 feet by 28 feet with gear reduction drive.

Day Dry Mixer and Sifter—3 feet by 4 feet by 8 feet.

3-inch Worthington Centrifugal Pump, with valves.

100 Feet of Roller Conveyor, 2 feet wide.

70 H.P. Vertical Boiler—return condensate system and Ray Oil Burner.

All in Excellent Condition. No Dealers.

MINERAL PIGMENTS CORP.

Muirkirk, Md.

• SHOVELS •

2—Model 490 Marion Combination

Shovels and Cranes, Electric.

Ward-Leonard Controls.

Each unit complete with 2 1/4 and 3 1/2 yard dipper buckets.

65" Crane Booms.

Rebuilt and Ready to Ship.

—Wire or Write—

Industrial Equipment Company

1301 59th Street,

Emeryville, California

WANT TO BUY

- 2 Locomotive Cranes
- 2 Whirley Cranes 80' or 125' Boom
- 5 Portable Conveyors 40' to 80'
- 3 1 1/2 to 2 ton Tandem Rollers
- 6 10,000 Gal. Cap. Steel Tanks
- 1 Mile Portable Track

Leicester Contracting Corporation
305 Madison Ave., New York, N. Y.

POSITION WANTED by experienced Const. Supt. and Foreman, 25 yrs. experience in all kinds of paving, dirt moving, also heavy sewer; available Feb. 15th. Sober and dependable; best of references. Box 5000, Roads and Streets, 330 So. Wells Street, Chicago, Ill.

RENT OR SALE

(1) 1 1/4 yd. Thew-Lorain No. 75 A. Shovel. Overhauled.

(1) 3/4 yd. Speeder Shovel, Caterpillar eng.

(1) 220 cu. ft. Gardner-Dever Portable Compressor.

(1) Jaeger Asphalt Paver, model-BP2.

(1) Complete portable crushing plant, 18" x36" Universal, etc.

M. WENZEL

5322 Aberdeen Road Kansas City, Mo.

TIRE REPAIRS

In all sizes of tractor, truck, wheelbarrow, passenger, or 1800x24 tires.

An EQUA-FLEX "Sectional" repair constructed in your tire is guaranteed. Best results and prompt service!

We have a selection of pre-war quality used passenger and truck tires.

WALLACE TIRE SERVICE, Inc.

2329 S. Michigan Ave. Chicago, Ill.

WANTED

1 Hubbard-Field Stability Tester. Please state style, condition of machine, number and size of molds, and price F.O.B. shipping point. Address reply to 5000.

ROADS AND STREETS

330 So. Wells St., Chicago, Ill.

COMPRESSORS

1—New LeRol 60 gas eng. driven Comp. on two-wheeled trailer.

1—New LeRol 105 gas eng. driven Comp. on two-wheeled trailer.

1—New LeRol 160 two-stage, gas eng. driven, mtd. on four steel wheels.

3—New LeRol 210 gas eng. driven on four steel wheels.

2—New LeRol 315 gas eng. driven, on four steel wheels.

1—Rebuilt Schramm 55 cu. ft. gas eng. driven, mounted on two-wheeled pneumatic-tired trailer.

1—Rebuilt Schramm 200 cu. ft. Portable, gas eng. driven, mtd. on four steel wheels.

WAGON DRILLS

1—New Cleve, DR-30 Wagon Drill, mtd on two steel-wheeled trailer, with 4" drifter drill, 6" steel change.

2—Rebuilt Cleve, WDA-10 Wagon Drills, mtd. on steel wheels, 4" drifter drill, 10" steel change, used three months, new machine guarantee.

1—Rebuilt Cleve, DR-8 Wagon Drill, used two months, guaranteed.

GENERATORS

5—New Lister-Blackstone "Nite Hawk" Portable 5 KW, 120 volts, AC, single phase, 60 cycle, Gen. Sets, compl. with four 1,000 watt Crouse-Hinds reflectors mounted on 8 ft. telescopic extensions mounted on two-wheel spring mounted trailer.

3—Slightly Used Kohler 1 1/2 KVA, 1800 watt, 120 volts, single phase, 60 cycle, used Lighting Gen.

1—Rebuilt 50 KVA Superior diesel eng. driven Gen., V-belt drive, 220 volts, 3 phase, 60 cycle, AC Gen., 8 power factor, powered with Superior 100 h.p. 6-cylinder diesel eng. Machine in excellent condition.

1—Rebuilt 18.7 KVA Superior diesel eng. driven Gen., direct connected, powered with 2-cylinder engine, 1200 r.p.m. and Columbia Gen., 220 volts, 3 phase, 60 cycle, 8 power factor Machine in excellent condition.

1—Rebuilt 30 KW Climax gas eng. driven Gen. Set, direct connected, 4-cylinder Climax engine, 220 volts, 3 ph. 60 cycle, 8 power factor, Machine in excellent condition.

5—New 6 KW Model 6000-M, Universal 115 volts, DC, manual control Gen. Sets.

CRANES

2—Rebuilt P & H Model 206, 3/4 yd. Truck Cranes, tandem drive, pneumatic tired.

1—Used P & H Model 600, Shore Front with 1 1/4 cu. yd. Dipper.

1—Rebuilt P & H Model 206 Crawler Crane, 3/4 cu. yd. with 35' boom, in excellent cond.

1—Rebuilt Northwest 105 gas driven Back-Hoe and Crane.

1—Rebuilt Link-Belt K-2 gas driven Clamshell and Crane with 60' boom.

BUCKETS

3—New Williams Model 13-M, 1/4 yd. General purpose Clamshell Buckets.

1—New Williams Model 20-X, 3/4 yd. Dragline Bucket.

1—New Williams Model 14-F, 1/2 yd. Clamshell Bucket.

1—Rebuilt Page 1 1/4 yd. Dragline Bucket.

1—Rebuilt Page 3/4 yd. Dragline Bucket.

PUMPS

2—New Carver 3", 10,000 g.p.h., mtd. on two-wheeled trailer.

2—New Carver 3", 7,000 g.p.h., mtd. on two-wheeled trailer.

7—New Carver 3", 15,000 g.p.h., mtd. on steel wheels, self-priming cent. pumps.

ROLLERS

4—Rebuilt Huber 10-ton, 3-wheel, gas eng. driven Rollers, rebuilt and guaranteed.

1—Rebuilt Gailon latest model 10-ton, 3-wheel gas engine driven Roller, complete with scarifier, electric starter, 24" rolls, lights and water tank, like new.

1—Rebuilt 5-ton, 3-wheel Gailon gas Roller.

1—Rebuilt 4-ton, 3-wheel Fordson Power, Austin Pup Roller.

2—Rebuilt 5-ton Gailon Portable tandem Rollers, gas eng. driven, like new.

MOTOR GRADERS

1—Rebuilt Huber tandem drive Gas engine driven Motor Grader, 12 foot blade, Deluxe cab lights, starter.

WELDERS

1—Used 150 amp. Wilson elec. Motor Driven Welder.

1—Rebuilt 600 amp. gas eng. driven P & H Welder.

CHICAGO CONSTRUCTION EQUIPMENT COMPANY

13912 South Halsted Street

CHICAGO, ILL.

PHONE RIVERDALE 1300



VULCAN PAVEMENT AND CLAY DIGGING TOOLS

ARE MADE in a complete line of sizes to fit all standard compressed air hammers.

Send for NEW Vulcan illustrated CATALOG today.

VULCAN TOOL MFG. CO.
QUINCY, MASS.

THAW CULVERTS AND HYDRANTS WITH AN AEROIL



No. 98 Portable Steam Thawer

A handy steam plant with a detachable thawing torch. Used by leading Highway Departments for Culvert Thawing. Special Culvert Nozzle (10 ft.) available. Send for WINTER CATALOG No. 2345 including Concrete Heaters, Portable Coil Water Heaters, Thawing Torches, Ground Thawers, Salamanders, Tar and Asphalt Heaters, etc. 1917-1942—25 YEARS OF SERVICE

AEROIL BURNER CO., INC.
371 PARK AVE. WEST NEW YORK, N. J.
Branches: Chicago, San Francisco, Dulles

G. H. Rogers Joins H. O. Penn Co.

G. Harvey Rogers has joined the staff of the H. O. Penn Machinery Co., New York, distributors of construction and industrial equipment. Previous to joining the Penn Co. Mr. Rogers had been with the Good Roads Engineering & Contracting Co. Inc., at Wantagh, Long Island, for a period of twelve and a half years.

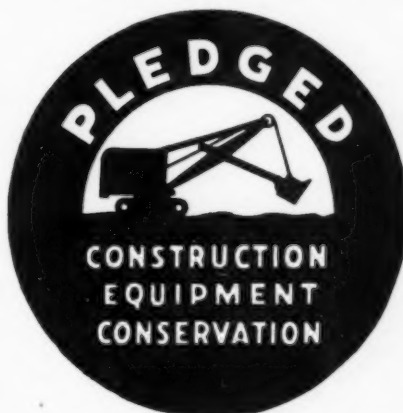


G. H. Rogers

Thew Shovel Asks Conservation Pledge as Important Aid to War Effort

Every contractor or operator using construction equipment has been asked by The Thew Shovel Co. of Lorain, O., to sign a pledge to conserve all the equipment in his possession in the interest of America's

war effort. This is believed to be the first time that a manufacturer of this type of equipment has made such a unique request. The company is attaching the pledge cards to its advertisements, and to everyone signing a card it is sending a red, white and blue emblem, (See illustration) which the operator or contractor may



This red, white and blue emblem is being sent by The Thew Shovel Company of Lorain, O., to every contractor and operator of industrial equipment who signs a pledge card pledging he will do everything possible to prolong the life of the equipment

display prominently on the equipment he is using. The company is also sending a book of instructions entitled "The Thew Lorain Emergency Fix-It Handbook" showing users how to make repairs without having to wait for new replacement parts. In asking that contractors and operators sign the pledge the company advises them to "show others that you are helping to make your equipment last longer and work faster . . . it's one big way you will contribute to victory." The pledge card or coupon reads as follows:

"I hereby pledge that I shall do all in my power to prolong the life of any construction equipment in my ownership or care, regardless of type or make.

"I realize that it is my responsibility to avoid time-consuming delays caused by mechanical breakdowns and will see that frequent inspections are made and that necessary adjustments and repairs are promptly taken care of.

"I will avoid waste of parts and materials and will eliminate any abuse of my equipment due to non-recommended operation."

WPB Stops Certain Construction Projects

Following the policy of curtailing construction which does not contribute

Reliance

CRUSHING, SCREENING and WASHING UNITS

• Up to 2000 Tons a Day •

Crushers	Bins	Drag-Lines
Elevators	Pulverizers	"GAYCO"
Sweepers	Feeders	Centrifugal
Screens	Spreaders	Air Separators
Wash Boxes	Kettles	
	Conveyors	

UNIVERSAL ROAD MACHINERY CO.
Kingston, N. Y.

Canadian Representatives: F. H. Hopkins & Co., Ltd.
340 Canada Cement Co., Montreal, Que., Can.

NEED A BIG Trailer?

La Crosse Makes Them
Up To 200 Ton Capacity—
★ WRITE OR WIRE ★

LA CROSSE TRAILER & EQUIPT. CO.
LA CROSSE, WISCONSIN U. S. A.

BAD GOING? Here's the Truck that eats it up!



If you need a truck for grading, hauling under the worst conditions, snow-removal or similar services you'll find nothing, anywhere, to equal a Marmon-Herrington All-Wheel-Drive converted Ford. Prices are surprisingly low, and operating costs a revelation in dollar-savings. Write for literature.

MARMON-HERRINGTON CO., Inc.
INDIANAPOLIS, INDIANA, U. S. A.

directly to the war effort, the War Production Board announced that projects having a total cost of \$56,344,612 were stopped during the week ended January 22. This brings to \$1,271,195,509 the total cost of all projects which have been stopped by either the programming agency or the War Production Board since Oct. 23, 1942, when the Facility Review Committee of WPB was established to re-appraise the essentiality of construction projects.

SAUERMAN LONG RANGE MACHINES



Sauerman Drag Scraper and
Portable Gravel Plant

PROFITS in digging and hauling sand, gravel, clay, blasted rock, etc., depend on using the simplest equipment that will handle the required yardage in the shortest space of time.

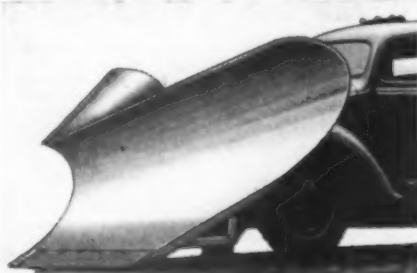
Often this means using a one-man operated Sauerman Drag Scraper or Slackline Cableway. The Sauerman system of moving materials adapts itself to any ground conditions and provides fast handling on any haul up to 1500 ft.

Write for Catalog

SAUERMAN BROS., Inc.

588 S. Clinton St., Chicago

Root



Root V-type and Oneway Truck Snow Plows have helped to keep war industries, Army Camps and Airports open and will continue to do so.

Root has enlisted for the duration and is now running 100% for Victory.

ROOT SPRING SCRAPER CO.

Kalamazoo, Michigan

Builders of Truck Maintenance
Equipment for more than 30 Yrs.

Index to Advertisers

The Dash (—) Indicates that the Advertisement Does Not Appear in This Issue

A		M	
*Adams Company, J. D....	Second Cover	Mack Trucks, Inc.....	—
*Aeroli Burner Co., Inc.....	97	Macmillan Petroleum Corp.....	—
Albi Chemical Corp.....	—	Magnus Chemical Co.....	86
Allis-Chalmers Tractor Division.....	16	Marion Steam Shovel Co., The.....	7
Alloy Steel & Metals Co.....	—	*Marmon-Herrington Company, Inc.....	97
American Bridge Company.....	—	Matchett Co., Paul L.....	96
American Cable Division.....	Third Cover	*Michigan Power Shovel Co.....	11
American Chain & Cable Co., Inc.....	—		
.....Third Cover			
American Cresoting Co.....	—	N	
American Cyanamid & Chemical Corp.....	—	National Automotive Fibres, Inc.....	—
American Steel & Wire Company.....	—	National Paving Brick Association.....	—
Anthony Co.....	94	Norgahn Co.....	—
Armco Drainage Products Ass'n.....	—	O	
Athey Truss Wheel Co.....	—	Ohio Oil Company, Inc., The.....	—
*Austin-Western Road Mach. Co.....	—	*Osgood Company, The.....	23
Auto Gear & Parts Co.....	—	*Owen Bucket Co., The.....	30
B		P	
*Baker Manufacturing Co., The.....	28	Paris Manufacturing Co., Inc.....	—
*Barber-Greene Co.....	6	Pierce Governor Co., The.....	—
Barrett Company, The.....	67	*Pioneer Engineering Works.....	61
*Bethlehem Steel Company.....	1	Pitman Publishing Corp.....	—
Blackhawk Mfg. Co.....	—	*Portland Cement Association.....	—
*Blaw Knox Company.....	89	Preformed Wire Rope.....	29
Briggs & Stratton Corp.....	—	R	
Brooks Equipment and Mfg. Co.....	—	*Rapid Pavement Breaker Corp.....	—
*Buckeye Traction Ditcher Co.....	19	Raybestos Division.....	92
Bucyrus-Erie Co.....	15	Raybestos-Manhattan, Inc.....	92
*Buffalo-Springfield Roller Co.....	—	*Reilly Tar & Chemical Corp.....	—
*Burch Corporation, The.....	—	Riddell Corp., W. A.....	—
Byers Machine Co., The.....	30	Rogers Brothers Corporation.....	30
C		Root Spring Scraper Co.....	98
Calcium Chloride Association.....	14	Rototiller, Inc.....	10
Chicago Constr. Co.....	96	S	
*Cleaver Brooks Company.....	—	*Sauerman Bros., Inc.....	98
Cleveland Rock Drill Co., The.....	—	Schramm, Inc.....	73
*Cleveland Tractor Co., The.....	34	Seaman Motors.....	—
Colorado Fuel and Iron Corp. Insert.....	65	Shannon & Co., J. Jacob.....	—
Concrete Cutting Corp.....	—	Sheppard Co., R. H.....	—
Concrete Surfacing Machinery Co.....	—	Sinclair Refining Co.....	91
Continental Motors Corp.....	—	*Sisalkraft Co., The.....	—
D		Standard Oil Company of California.....	—
Deere, John.....	—	Standard Oil Company (Indiana).....	93
*Diamond Iron Works, Inc.....	—	Star-Lite Co., The.....	—
Dietz Company, R. E.....	—	Stulz-Sickles Co.....	87
Dixon Valve & Coupling Co.....	—	T	
E		Telford Equipment Co.....	—
Electric Wheel Co.....	75	*Texas Co., The.....	Back Cover
Empire Electric Brake Co.....	33	Thew Shovel Co., The.....	3
*Etnyre & Co., E. D.....	—	Thornton Tandem Co.....	—
F		Tidewater Equipment & Machy. Corp.....	—
Fate-Root-Heath Co., The.....	95	Timber Engineering Company, Inc.....	61
*Flexible Road Joint Machine Co.....	—	Timken-Detroit Axle Co.....	—
Footo Company, Inc., The.....	17	*Timken Roller Bearing Co., Front Cover	—
*Four Wheel Drive Auto Co., The.....	5	Toncan Culvert Mfrs. Ass'n.....	—
G		Truscon Laboratories.....	—
*Gallon Iron Works & Mfg. Co., The.....	4	*Tuthill Spring Co.....	—
Gatke Corporation.....	87	U	
Gemmer Manufacturing Co.....	—	Union Metal Manufacturing Co., The.....	20
*General Excavator Company.....	23	United States Steel Corp.....	—
Gohl Culvert Manufacturers, Inc.....	—	Universal Atlas Cement Co.....	—
Grace Mfg. Co., W. E.....	95	Universal Crane Division.....	—
Grohne Concrete Products Co.....	—	*Universal Engineering Co.....	22
*Gruender Crusher & Pulverizer Co.....	30	Universal Road Machinery Co.....	97
Gulf Oil Corporation.....	—	Universal Unit Power Shovel Corp.....	—
H		V	
Hazard Wire Rope Division.....	—	Vulcan Tool Mfg. Co.....	97
*Heltzel Steel Form & Iron Co.....	13	W	
*Hercules Co.....	23	Wallace Tire Service, Inc.....	96
*Hercules Power Company.....	—	Walter Motor Truck Co.....	18
Hercules Steel Products Co.....	70	Warren-Knight Co.....	85-96
Hetherington & Berner, Inc.....	71	Warsaw Iron Wks.....	69
Hi-Way Service Corp.....	69	*Wellman Engineering Co., The.....	69
Huber Mfg. Co.....	26	Wenzel Tent & Duck Co., H.....	—
I		WGB Oil Clarifier, Inc.....	—
*International Harvester Company.....	21	Wheeler Lumber Bridge Supply Co.....	95
*Iowa Mfg. Co.....	8-9	White Mfg. Co.....	—
J		Wiley & Sons, Inc., John.....	24
*Jaeger Machine Co., The.....	85-87	*Williams Form Engr. Corp.....	24
Jones & Laughlin Steel Corp.....	—	*Wisconsin Motor Corp.....	25
K		Wood Mfg. Co.....	25
Klauser Manufacturing Co.....	—	Wood Preserving Division Koppers	—
Koehring Company.....	31	Co.....	—
Koppers Company.....	—	Worthington Pump and Machinery	—
*Kotal Company.....	—	Corp.....	—
L		Y	
*La Crosse Trailer & Equipment Co.....	97	York Modern Corp.....	—
Leicester Contracting Corp.....	96	* Advertisers with * are represented in	
Le Tourneau, Inc., R. G.....	27	the 1942 edition of Powers' Road and	
Lima Locomotive Works, Inc.....	27	Street Catalog and Data Book. Please refer	
*Littleford Bros.....	12	to it for additional information on	
		any of their products.	

30% OF ALL INDUSTRIAL ACCIDENTS ARE TO HANDS AND FINGERS



According to the National Safety Council, 30% of all time-out, industrial accidents are to fingers and hands. 20% of these accidents result in infections. And a workman who has lost his hand through infection is just as incapacitated as if he had lost it in a punch press or buzz saw.

We hope you have never had a lost-time accident due to wire rope. Some operators have, however, and 1943 is no time to have workmen laid up with blood-poisoned hands. Many operators have drastically reduced accidents (and compensation claims) by adopting American Cable **TRU-LAY** *Preformed*—the safer rope.

Being *preformed*, American Cable **TRU-LAY** is tract-

able—flexible—easy to handle. It resists kinking and snarling. Worn or broken crown wires lie flat and in place—refusing to wicker out to puncture hands or tear clothing...Furthermore, being *preformed*, **TRU-LAY** will last longer than ordinary cable. It has far greater resistance to bending fatigue. That means reduced machine shutdowns for replacement—steadier production—greater dollar value. . . . All American Cable ropes identified by the Emerald strand are made of Improved Plow Steel.

WHEN ROPES ARE WORN



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ESSENTIAL PRODUCTS . . . **TRU-LAY** Aircraft, Automotive, and Industrial Controls, **TRU-LOC** Aircraft Terminals, **AMERICAN CABLE** Wire Rope, **TRU-STOP** Brakes, **AMERICAN** Chain, **WEED** Tire Chains, **ACCO** Malleable Castings, **CAMPBELL** Cutting Machines, **FORD** Hoists, Trolleys, **HAZARD** Wire Rope, Yacht Rigging, **MANLEY** Auto Service Equipment, **OWEN** Springs, **PAGE** Fence, Shaped Wire, Welding Wire, **READING-PRATT & GADY** Valves, **READING** Electric Steel Castings, **WRIGHT** Hoists, Cranes, Presses . . . *In Business for Your Safety*

THE *Why* OF LONGER-LIVED CHASSIS PARTS

This demonstration of the cohesiveness of Texaco Marfak shows why it stays put, thus protecting chassis parts so much longer than ordinary lubes.



1. Try smearing Marfak across your palm. Note the tough film that cannot be broken no matter how heavy the pressure. This great film-strength is your assurance of more effective lubrication of all chassis parts.
2. Twirl Marfak around and around (as in a grease-lubricated universal joint). See how its cohesiveness holds it together.
3. Try to separate your fingers with Marfak between them. That "pull" demonstrates its adhesiveness, or its ability to cling to metal parts.

YOU can cushion chassis parts against road-shocks, lengthen their life, and reduce the time and labor spent in lubricating shackles, steering connections, etc. . . . by using *Texaco Marfak*.

Texaco Marfak provides a tough, adhesive-cohesive film that clings to metal, resisting the severest rain and road splash.

The reason behind *Marfak's* longer-lasting protection is this—while it liquefies inside a bearing, providing liquid lubrication, it maintains its original consistency at the outer edges, thus sealing itself in while sealing out dirt, grit, water.

For wheel bearings in heavy-duty service, specify *Texaco Marfak Heavy Duty* . . . it stays in bearings and off brakes . . . protects against wear.

Outstanding performance has made Texaco first in each of the fields listed below.

These Texaco users enjoy many benefits that can be yours. A Texaco Automotive Engineer will gladly cooperate in the selection of the most suitable lubricants for your equipment . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 E. 42nd St., N. Y., N. Y.

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

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U. S. is lubricated with Texaco than with all other brands combined.

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